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UNITED STATES DEPARTMENT OF AGRICULTURE

Radio Service

OFFICE OF INFORMATION

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CHATS WITH THE WEATHER MAN — Friday, January 10, 1930

NOT FOR PUBLICATION

ANNOUNCEMENT: Every other Friday, our old friend Ob. Server tells us something new about the weather and the weather men. He keeps in touch with the weather-wise men of the United States Weather Bureau. From what he tells me, they are not only reaching out into other countries for more facts about the weather but are also reaching up further and further beyond the clouds for information--------- but I'll let old Ob Server himself tell you about that-----

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What takes place in the upper air, often has a big effect, on the kind of weather we get down here on the ground. It now seems that the general storms, which pass over us, are dragged along by the much faster, steadier winds which generally move from west to east two to four miles up and beyond.

Anyway, Mr. W. R. Gregg, in charge of the aerological division of the United States Weather Bureau, tells me that instead of relying on weather observations taken near the surface, our forecasters now make use of eight separate charts showing wind conditions at the surface and at seven other levels of air up to three or four miles.

Each of those eight maps is marked with little arrows showing the direction the wind is blowing at that level and with figures indicating how fast it is blowing. As what is happening at one level may determine what will happen at another level, the weather man needs a complete picture.

In order to find out about those winds aloft the weather experts send up little balloons which when fully inflated with hydrogen gas are a little over two feet in diameter. From tests it has been found that these balloons rise at the steady rate of 600 feet a minute until they finally burst in the rarer air far aloft. But while the balloon is going up, the observer keeps a theodolite, a telescopic instrument much like a surveyor's transit, sighted at it. Each minute, he reads from the instrument the angle formed by the floating balloon with its starting place. Knowing the speed at which the little gas bag rises and the angle, it is a simple matter to calculate its height and the speed at which it is moving horizontally--- That is the speed of the wind which is shoving it along at that height. Information of wind conditions up to three or four miles is obtained in this way at night, the balloons are sent up with lanterns attached.

Mr. Gregg says that we now have 45 regular Weather Bureau stations making the pilot-balloon reports in this country. Through cooperation of the Army and Navy, pilot balloon reports are also obtained from about 12

other points, including flying fields and ships at sea and outlying points such as San Juan, Cuba, and Honolulu, Hawaii.

Another of these upper air weather stations will shortly be established at Fairbanks, Alaska, and, as Mr. Gregg points out, that will come in handy for the "Graf Zeppelin" this spring when she makes Fairbanks her base for her flights into the Arctic regions.

Of course, the most direct and immediate use of upper air weather information is for forecasts for aviators. The chief of the Weather Bureau's aerological division, points with pride to the fact that a pilot flying from Cleveland to Chicago established a record. He covered the distance in less time than had previously been made by use of Weather Bureau information about upper air currents. He gets a big boost on his way by flying much higher than usual and catching a strong tail-wind shown by weather reports at the higher level.

However, that record breaking flight is cited merely as an illustration. Upper air reports are used as a practical guide by air pilots all over the country every day.

And besides the regular pilot balloon observations made twice a day or oftener, the observers at the upper air stations send up smaller balloons, known as "ceiling" balloons, when there are low clouds. The reports from these observations give the airmen the most vital information as to the exact height of the clouds or the flying "ceiling," and enable them to decide whether it is safe to attempt flights across mountains, and so forth.

In addition to the facts about the ceiling and wind obtained from the ceiling and regular pilot balloons, some of the Weather Bureau upper air stations also make use of kites and airplanes equipped with automatic recording instruments to get the temperature, and pressure, and humidity, and wind of the upper air.

In fact, the scientists of the Weather Bureau are reaching even further up than through the air levels now used for practical aviation and surface weather forcasting. They are probing the rarer heights for fundamental facts which may affect our weather here below. In that research they send balloons equipped with instruments up seven or eight miles and have even obtained records as high as twenty miles up.

And talk about cold weather; Mr. Gregg says they have found that 7 or 8 miles above ground the temperature is 65 below zero, on the average. It stays that way from one year's end to the next, summer and winter. You see, the further up you go, the more constant and widespread conditions become. That is the reason, it doesn't take as many stations for making upper air observations as are needed for effective work here one the surface.

But there is some variation with latitude and season even as high as is reached. Just what are those variations and why, the leading national weather services of the world are now cooperating to find out.

During the same month each year, soundings are made in the different countries.

Last month was the month, and our Weather Bureau made a series of soundings at Broken Arrow, Oklahoma. For these higher soundings, balloons three or four feet in diameter were used. They carried light instruments equipped with clock-driven drums on which pens record on paper the temperature and pressure conditions at the great heights. The recording instruments were provided with small parachutes to bring them down safely and were marked with a tag offering five dollars payment to the finder for returning to the address given.

But what is beyond the greatest height reachable by a balloon? Some say that, 100 miles up, the temperature reaches a frightful frigidity. Others claim, on the contrary, that at that distance from us temperatures are terribly torrid. To get some information on that subject, officials of the United States Weather Bureau are even now planning to co-operate with other scientists in this country in making recording instruments to be used in a rocket which it is planned to shoot into space in an effort to gain more information on the forces which control our weather.

Any added knowledge which may be had from these scientific researches Mr. Gregg says, may eventually contribute to the practical value of the upper-air weather forecasts for aviators and the regular surface weather forecasts which affect each one of us.

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ANNOUNCEMENT: Our Ob. Server will again talk with the audience of Station _____ two weeks from today. At that time he will bring us some more information on the weather and how we are finding out about it.

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UNITED STATES DEPARTMENT OF AGRICULTURE — Radio Service — OFFICE OF INFORMATION

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CHATS WITH THE WEATHER MAN — Friday, January 24, 1930

LIBRARY RECEIVED JAN 9 U.S. DEPT. OF AGR.

NOT FOR PUBLICATION

Speaking Time: 10 Minutes. — All Regions

OPENING ANNOUNCEMENT: At this time Station____is going to present our old weather friend, Ob. Server. He is a weather-wise person and tells us many interesting things about the weather, and what Uncle Sam's Weather Bureau is doing to interpret it. Ob. Server is going to talk about snow today so you had better pull on an extra coat. All right, Mr. Weatherman.

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Well folks, put on a heavy coat, build a big fire, and pile up plenty of firewood---I'm going to talk about SNOW, and you may get just a little chilly before we get through.

One time a cook was ordered to prepare the best piece of meat obtainable for his master's dinner. He prepared tongue. The next day he was ordered to prepare the meanest piece of meat obtainable for his master's dinner. Again he prepared tongue. The cook believed tongue could be the best or worst piece of meat in the world, depending on whether it was used for good or for evil purposes.

Now snow is very much like tongue. It can be one of man's best friends, or it can cause him about as much trouble and misery as anything Old Man Weather has to offer his millions of inquisitive people waiting to see what he is going to do. Some sections of the United States experience very heavy and frequent snowfalls during the year, other sections have occasional snows, but every State in the Union is subject to snow, at least in portions; therefore, this talk will be of interest to all of you whether you live in the sunny South where snowflakes come once in a leap-year, or out in the Sierra Nevada Mountains of California where snow is a regular feature of the winter. I thought you radio listeners would be interested in knowing something about our beautiful snow that the poets write about, so I got in touch with Dr. P. C. Day, in charge of snow and ice investigations for the United States Weather Bureau. Dr. Day has been tinkering with the weather for more than 45 years, but he has never been able to do a thing with it. He's as helpless as the Georgia cotton farmer or the California sheep raiser;---all see the weather,--and all they can do is talk about it, as Mark Twain once pointed out.

For convenience let's make three divisions of this talk. First, let's find out what snow is, and what causes it. Second, let's find out what sections have the most snow, and third, let's find out whether snow is good or bad for this country and its people. Here goes the first subject, "What is snow?"

According to Dr. Day snow is ice crystals formed from water vapor. Way up in the air a thousand feet or more above the surface of Old Mother Earth, moisture starts condensing. Sometimes this condensed moisture falls in the form of rain, sometimes ashail and sometimes as snow. What this moisture will be when it hits the ground depends on the temperature of the air it passes through in transit. Very often we have rain falling which freezes just after it strikes

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the ground or trees. This is called glaze and has caused thousands of people, including myself and many of you listeners, to take a hard and unexpected seat. Sleet is frozen raindrops or pellets of ice formed some little distance up in the air. Snow is formed from about a thousand feet above the earth up to miles high. All forms of precipitation decrease after about 6,000 feet up. The decrease is more noticeable in some sections of the country than others. Topography probably determines that.

Snow forms at the temperature of freezing or below. If the temperature rises, the snow turns to rain. It may be raining in an upper current or stratum of air and sleeting on the ground, or snowing in the upper and raining below. Most of you listeners have seen snow turn to rain as it approaches the ground due to a warmer air. Snow may be dry, hard and glassy, and then again it may be soft, moist and velvety. Often one sees snowflakes so large as to resemble a combination of many flakes into one. This may or may not be the case. That's another one of the weather mysteries.

Now let's take an airplane trip over the United States and see for ourselves just where snowfall is the heaviest. I had better add that 10 inches of snow whenmelted usually equals about one inch of rainfall. We'll start from an air field in central Maine. The time is January 24, and the year is 1928, and these records are the ones actually set down that year. The country looks like an unbroken snowfield; the snow is more than 15 inches deep over most of the New England States. The average fall for the year up there is 70 inches.

Here we are in Washington and there's the White House, the Capitol, and those red brick buildings at 24th and M Streets which constitute the U. S. Weather Bureau. Washington averages about 22 inches of snowfall per year.

This is a fast airplane and we're now sailing high over Atlanta, Montgomery, New Orleans and the beautiful Gulf Coast. These southeastern states average from one to three inches of snow per year. Most of this is in the northern part, and in some years sno snow falls, but occasionally the white mantle sifts to the earth as far South as northern Florida, as it did in December, 1929.

We're following the Mississippi River to St. Louis. There's a city with an average per year of 19 inches of snow. Now up the Mississippi a piece then we'll fly straight across to the Pacific Ocean, if we can rise over the Rocky Mountains. Below is Iowa with an average of 29 inches of snow. Seon we pass Wyoming with 51 inches and next is Idaho with 59, and by speeding up the motors we're able to glide over the mountains, and into California, which has from no snowfall in the South to the heaviest in the United States in some of its mountain sections. Florida has the least snowfall, and California, in some parts, has the heaviest---amounting in places to more than 800 inches in some years.

Some sections of the northwest have such heavy snowfalls that at times they are almost snowed in. In some instances you see the tops of trees and tops of houses instead of the whole. The remainder is covered in snow. In crossing the mountains we sailed high above the transcontinental railway but you didn't see many trains. They were there all right, going right along at a rapid clip, but running under snowsheds covered 15 to 30 feet deep in snow.

Snow is light or heavy depending on whether it is wet or dry snow. Dry snow is light; wet snow is heavy. The weight of snow becomes quite a problem in some sections. Railroad snowsheds are often braced with 12-by-14 inch solid

timbers, sometimes even these give way as a result of the tremendous weight of the snow. Flat-roofed buildings are conspiciously absent in the regions of heavy snowfall; gabled buildings with very steep roofs are used so the snow will slip or slide off from its own weight.

Many of you listeners can recall the winter of 1922 when the heavy snow apparently caused the roof of the Knickerbocker theatre in Washington to cave in, and snuff out the lives of many, many people.

A railroad decided to landscape the ground about one of its stations in the region of heavy snowfall. A pipe fence was made from discarded two inch boiler flues. The snows that winter got so deep and heavy that these two inch steel pipes were bent until many of them dropped from their holes in the posts. Snow is not only beautiful, white, and cold, but it's heavy.

Does it get too cold to snow? No. However, when the air gets rapidly colder the snow generally stops, but that is because the air in the clearing-up side of a storm usually is colder than it is in the snowy or rainy section, and not because it is too cold for snow to form.

Do we have as much snow as we used to have? Thomas Jefferson once remarked that we did not, and that the snows melted quicker than they used to. According to Dr. Day and the Weather Bureau records, we have as many snows as we ever had, they are as heavy, and remain on the ground as long when we take averages of, say, 10-year periods.

Now what good does snow do? Well, it does harm by interrupting taffic, transportation, and freezing livestock and even people. Losses from these sources are decreasing because people are preparing for the snows and protecting themselves and their property and livestock against them. A sudden snow in some southern sections often does more harm because of unpreparedness, than the heaviest snows in sections accustomed to them.

Snow is coming to be a great economic factor since irrigation has been established. The melted snows are caught in huge reservoirs and held for the growing crops. Snows help the grain crops by bringing down fertilizers, like ammonia, from the air, by spreading a blanket over them, that prevents alternate thawing and freezing, or winter killing, and by supplying moisture which soaks into the ground instead of running off. Snow supplies moisture in some sections where rain seldom falls. California probably profits more from her heavy snowfalls than any other one state. That's probably because she is so big and it needs the water.

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CLOSING ANNOUNCEMENT: You have just listened to our friend the old weather Ob. Server, talk about snows. The snow storm is over, and you listeners can now take off your coats. Ob Server will be with us again with some more information about the weather exactly two weeks from today.

UNITED STATES DEPARTMENT OF AGRICULTURE
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U. S. Department of Agriculture

CHATS WITH THE WEATHER MAN. Friday, February 7, 1930.

NOT FOR PUBLICATION

Speaking Time: 10 Minutes All Regions.

OPENING ANNOUNCEMENT: At this time Station_____is going to present our old friend Ob. Server. He is a weather-wise person and tells us many interesting things about the weather and what Uncle Sam's Weather Bureau is doing to interpret it. Ob. Server is going to talk about lightning today. All right, Mr. Weatherman.

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Well folks, get ready----we're going to have a thunderstorm so we can get some lightning to talk about.

It's now about three o'clock in the afternoon of a hot summer day. That's about the time when thunderstorms boil, roar, and put on a first class show. Look at those 'thunder-heads' climbing up in the west. Watch the clouds gather. Did you hear that thunder?

Now folks, I'm telling you that certainly is a black looking cloud gathering back there in the west. Listen to that thunder roll. Boy, it's going to rain when that cloud gets here. Gee whillikens----did you see that flare of lightning? What a flash---that almost blinded me. Look at those streaks of lightning as they dart towards the earth. Did you see that forked lightning? Man, what a clap of thunder. I'll bet that struck something. Take out the teams---Hurry----Come on let's get away from here.

Conversations similar to the above take place in many thousands of fields throughout this country when thunderstorms put on those spectacular lightning shows. We all see the lightning----we know that it is lightning, and we know that it'll hurt what it hits-but-------that's about as far as we can go.

I believe most of you radio listeners are interested in this subject, so come on, let's go over to the United States Weather Bureau and have a talk with Dr. W.J. Humphreys, who is Uncle Sam's meteorologist that tinkers around with the elements up in the air. Dr. Humphreys came from West Virginia, and he's been monkeying with the weather for a long, long time, but he's never been able to control it yet.

According to Dr. Humphreys we call a thunderstorm by that name probably because the thunder is noisy and disturbs us. It rains, the wind blows, and the lightning flashes in a thunderstorm, and these agencies can be seen and felt. We hear the thunder, but outside the effect of noise on tender nerves it does not harm us. Thunder is like the bark of a dog, or the report of a gun. They do us no harm. The bite of the dog, the bullet from the gun, and the lightning from the thunderstorm are the harmful agencies.

I used to think you could hear it thunder 50 miles, but Dr. Humphreys said

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Broadcast Time: 10 Minutes All Networks.

[illegible] ANNOUNCEMENT: At this time [illegible] is going to pause
[illegible] Sponsor. He is a weather-wise person and tells us only
[illegible] about weather and when Uncle Sam's Weather Bureau is wrong
[illegible]. Mr. Sponsor is going to tell about lightning today. All
[illegible].

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[illegible], are ready----we're going to have a thunderstorm
[illegible] thing to talk about.

[illegible] now about three o'clock in the afternoon of a hot summer day. [illegible]
[illegible] like when it thunderstorms hail, sleet, and put on a [illegible] show.
[illegible] those thunderstorms shaking up the two. Have you ever
[illegible] under that thing of

[illegible], I'm telling you it's certainly in a black hovering cloud mull-
[illegible] there in the west. Listen to that thunder rolll. Boy, it's going to
[illegible] that cloud over there. Has writhing----writhing is see the
[illegible] What an ugly----that almost blinded me. Look at that [illegible]
[illegible] as silver dart rounds the earth. Did you ever think how [illegible]
[illegible], it's a clap of thunder, I'll bet that struck something. [illegible]
[illegible]----from the [illegible]'s get away from here.

[illegible] afternoon [illegible] to the above true picture in [illegible] thousands of [illegible]
[illegible] out to [illegible] when thunderstorms put on those spectacular displays
[illegible]. Of course the lightning----we know that it is [illegible], as [illegible]
[illegible] it has a way it hits but----that's about [illegible].

I believe most of our radio listeners are interested in this [illegible],
[illegible], isn't it? In the United States Weather Bureau [illegible]
Mr. W.C. Stephenson, who is Uncle Sam's meteorologist that [illegible]
[illegible] lightning up in the air. Dr. Stephenson came from West Virginia, [illegible]
[illegible] work in with the weather for a long, long time, but he's now [illegible]
[illegible] control in work.

[illegible] to Dr. Stephenson we call a thunderstorm by what [illegible] produces
[illegible] thunder is lightning and storms us. It rains, the wind blows, and
[illegible]. Electric in a thunderstorm, and there originates what [illegible]
[illegible]. Mr. [illegible] the thunder, but entailed the effect of [illegible]
[illegible] [illegible] storm. Thunder is like the bank of a day, [illegible]
[illegible]. They [illegible] is no doubt. The pitch of the day, the [illegible]
[illegible] [illegible] thunderstorms are the powerful [illegible].

[illegible] to think you could hear it thunder 30 miles, but Dr. [illegible]

I heard too well. He said that 10 miles was a long distance to hear the loudest thunder. Now when it comes to seeing the dim flash of lightning, that's different! Light can be seen a long way on a dark night.

When I was a little boy I saw all kinds of lightning because I was naturally in the seeing stage. I used to see sheet lightning, streak lightning, forked lightning, and then big balls of fire. Dr. Humphreys said he thought I saw too many kinds of lightning. He said he had heard about sheet, streak, forked, chain, and ball lightning, but he thought 2 divisions would take most of our lightning! Here they are.

First, streak, forked, or chain lightning, are all the same, depending on how you see them. Sheet lightning is apparently the reflection of streak lightning that is hid from your view by a cloud or some object. There is a second classification sometimes called ball lightning, but it's too rare to discuss, and we don't know much about it either.

Lightning is simply the jumping of an enormous spark from point to point in a cloud, from cloud to cloud, and less frequently from clouds to the earth. Lightning can be likened to the spark that jumps the gap in the sparkplug. Much more lightning takes place among the clouds than from the clouds to the earth. However, occasionally a tremendous spark jumps from the clouds toward the earth, and if it's not exhausted before it reaches the earth, it'll strike and ground itself.

The duration of a flash of lightning varies. In some instances it's as short as two-ten-thousandths of a second, and in other instances, the series of subsequent discharges may last for a whole second or even longer..

We all have our own imaginations and we use them when it comes to the length of a flash of lightning, and the length of the streak. Our beliefs don't tally with the records at the Weather Bureau, but they have the instruments and can make accurate readings so we'll have to give in. How long is the longest streak of lightning you ever saw? Dr. Humphreys said lightning streaks varied in length from practically nothing to 10 miles.

How hot is lightning? That's a question that always interested me.

Well, it takes about one-third of an ampere of electricity to burn the 40 watt light globe in your 110 volt lighting circuit. It is believed that heavy streaks of lightning contain as much as 100,000 amperes. That's quite a bit larger than the amount required to burn the light globe, and that means lightning is hot----really hot. It can melt a piece of iron or fuse metal in the twinkling of an eye. Dr. Humphrey has records of lightning heating rods to 1050 degrees Centigrade.

I used to hear it said that an old tree, barn, or haystack, struck by lightning, kept right on burning until it was destroyed regardless of how hard it rained. In other words, rain would not put out lightning fires. Nothing to this according to the specialist. If lightning strikes a haystack it usually runs down the pole to the ground. In such cases the haystack is fired within all the way to the ground, and inside where it is dry, regardless of how hard it is raining on the outside. In such instances that haystack is going to burn about up because it's burning from within where it's dry. Likewise with barns, and old dead trees.

What makes lightning glow, or light up? According to Dr. Humphreys the answer to that question is not definitely known. The streak of lightning must, and does make the air path very hot, but probably not enough to make the light observed. It therefore, seems that the luminosity of a lightning flash is due in part to something other than high temperature.

Now let's see how many different colors of lightning you have seen. Lightning flashes have been reported for every color in the spectrum, but most of these colors fall under white, yellow, pink, or rose.

Is lightning beneficial?

Well, it brings down ammonia, and in the tropics where thunderstorms are severe and frequent, it has been proven that this ammonia is sufficient to be beneficial to plant life.

Where does lightning occur?

The South, especially Florida, and the West, probably see the greatest amount of lightning in this country. The Pacific Coast probably receives the least. I'm talking about thunderstorms accompanied by severe lightning discharges. Of course all sections have lightning at times.

Thunderstorms and lightning are most frequent in the hot summer, but they occur even in winter, and may be dangerous then because the clouds are so close to the ground.

Automobiles, ships at sea, and practically all objects may be struck by lightning. Ships with iron mastpoles pointing skyward simply ground the lightning. Automobiles with steel bodies pass the lightning right off to the ground.

It is safer to be indoors during a thunderstorm, and especially if the house has a well-grounded metallic roof, or if it's properly protected by lightning rods.

The storm is over and we'll have to close. If you desire more information, write this station for a bulletin called, "PROTECTION OF BUILDINGS AND FARM PROPERTY FROM LIGHTNING." It's Farmers' Bulletin No. 1512 and is free for the asking. Good bye for two weeks.

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CLOSING ANNOUNCEMENT: You have just heard Ob. Server talk about lightning. He'll be back again in two weeks with more weather information. This is one of the regular weatherman programs coming to you every two weeks through the cooperation of the United States Department of Agriculture and Station_____.

UNITED STATES DEPARTMENT OF AGRICULTURE

Radio Service

OFFICE OF INFORMATION

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U. S. D...

CHATS WITH THE WEATHER MAN. Friday, February 21, 1930

NOT FOR PUBLICATION

Speaking Time: 10 Minutes All regions

PROTECTING FARM PROPERTY FROM LIGHTNING

OPENING ANNOUNCEMENT: At this time Station____ presents our old weather friend, Ob. Server. He is a weather-wise person and tells us interesting things about the weather, and what Uncle Sam's Weather Bureau is doing to interpret it. Protecting farm property from lightning is the subject of Ob. Server's talk today. All right, Mr. Weather Man.

--ooOoo--

Lightning is an electrical monster of tremendous power. It is destructive, dangerous, and deadly unless he is tamed. Just two weeks ago I tried to tell you something about lightning. Today, I'm going to try to tell you how to protect yourself and your property from this electrical giant.

To get the latest information on this subject I went over to Uncle Sam's Weather Bureau and had a long talk with Mr. Roy N. Covert, who includes with his other duties the answering of questions about protection from lightning. Mr. Covert wrote Farmers' Bulletin No. 1512-F, entitled "PROTECTION OF BUILDINGS AND FARM PROPERTY FROM LIGHTNING." Every farmer ought to read this bulletin. It's free for the asking.

It is not necessary for us to talk about how hard lightning can strike, how completely it may destroy a tree, or how many animals it can kill in a pasture. We know it can do all of these things, and do them all toowell. The deadly, destructive power of lightning is not questioned at all. Let's frankly admit that lightning can do unbelievable things, and then pass to the subject of protecting ourselves and our property from it.

Lightning kills about 500 people in this country every year. This information comes from the Census Bureau. It injures about 1,300 people. About nine-tenths of all the people killed by lightning are killed in the rural districts. This indicates that the lightning hazard is by far greatest among persons engaged in outdoor pursuits. That certainly does include the farmer, and of course, it goes without saying that he is interested in protection from lightning.

ART FOR PHILOSOPHY'S SAKE

PHILOSOPHY FOR ART'S SAKE

Now the actual danger of personal injury from lightning is, in general, very small, except under certain circumstances of exposure out of doors, which, as a rule, can be avoided. Cases of injury from lightning are relatively rare within buildings of considerable size, or dwelling houses of modern construction. Lightning injuries are more frequent within small unprotected buildings of the older type. Isolated schoolhouses and churches where people may congregate during thunderstorms present a considerable lightning hazard if unprotected.

I told you two weeks ago that very few bolts of lightning jump from the clouds to the earth or from the earth to the clouds. Most of the lightning we see jumps from point to point in a cloud or from one cloud to another cloud. However, occasionally a big spark jumps earthward, and it will hit whatever is in its path. Of course, as a general thing, the more thunderstorms you have, the greater are the chances for these occasional bolts to jump to the earth. The west coast of Florida has about 90 thunderstorms per year. Out in Kansas the average is about 50 per year. They decrease to about 20 along the Canadian line from Quebec to North Central Montana. There is a whirlpool of thunderstorms in the mountains out in New Mexico and southern Colorado where the average increases to 50, 60, and 70 per year while most of the area roundabout has an average of between 30 and 40 thunderstorms per year.

Now what are you going to do to protect yourself when one of those severe thunderstorms occurs? Well some people get into a cellar, others believe they they are safe in a feather bed. Here's what the authorities say about protecting yourself from lightning:

"Do not go out of doors or remain out during thunderstorms unless it is necessary. Stay inside of a building where it is dry, preferably away from fireplaces, stoves, and other metal objects. If there is any choice of shelter, choose in the following order:

First, large metal or metal-frame buildings.
Second, dwellings or other buildings which are protected against lightning.
Third, large unprotected buildings.
Fourth, small unprotected buildings."

Now if you have to remain out of doors during a thunderstorm, you are warned to keep away from places named in the following order:

First, keep away from small sheds or shelters if they are in an exposed location.

Second, keep away from isolated trees.
Third, stay away from wire fences.
Fourth, keep away from hilltops and wide open spaces.

Now what are you going to do when you are out squirrel hunting and a bad thunderstorm comes up? You are advised to seek shelter in dense woods, a grove of trees, a cave, a depression in the ground, a deep valley or canyon, or at the foot of a steep or overhanging cliff. And the final word is: Don't take chances with lightning."

flow [illegible] ...

[illegible] ... more frequent with [illegible] ...

[illegible] two [illegible] ... [illegible] ... [illegible] ...

Now I have told you how to take care of yourself in a thunderstorm, and I have also told you what sections of the country have the most thunderstorms. Next we'll take up the protection of property from lightning.

The United States Weather Bureau believes that lightning loss is a great deal larger than it ought to be. At least $13,000,000 worth of property is destroyed every year by lightning. This much is actually reported, by the National Board of Fire Underwriters and that much more they estimate may be destroyed but unreported. In some of the Middle Western States lightning occasionally leads the list of causes of fire loss. This was true in Kansas, Oklahoma and Iowa in 1925. Lightning rods are used extensively in the sections just mentioned and that no doubt cuts down a big share of loss.

I guess you radio listeners wonder just how lightning rods protect buildings from lightning. Mr. Covert explains that lightning strikes buildings that are rodded just the same as those which are not rodded. Where lightning rods are used, well insulated and grounded, they form a path which the lightning follows so that the building suffers little or no damage. Lightning striking an unrodded building built of non-conducting materials causes considerable damage by shattering the non-conductors in its path to earth. But most of the losses are due to the fires resulting when the electric current passes through inflammable materials such as are frequently stored in farm barns. Such damage is almost entirely prevented by proper rodding.

Now what is a protected building? Well, it's a building usually with metal uprights called air terminals projecting upward from the highest part of the structure such as peaks, gables, chimneys, dormers, ventilators, etc. These air terminals are connected electrically to permanent moist soil by two or more down conductors and ground connections. The important ground connection to which the down conductor is attached consists of a buried body of metal, often an extension of the down conductor, which, as a rule, extends well into permanent moist soil, that is to a depth of 8 or 10 feet into the earth.

About fifty per cent of the farm buildings in Iowa are rodded. In 2 years 28 of these rodded buildings were destroyed by lightning fires. During the same time 503 unrodded buildings were destroyed. It's quite possible that many of the 28 rodded buildings were improperly rodded or poorly grounded.

If your farm is in the path of frequent thunderstorms, and your buildings are valuable, or house valuable crops -- or livestock -- then it might be profitable for you to consider rodding such buildings. Rodded buildings very frequently take a lower insurance rate, and the cost of rodding often becomes an economic investment.

The Washington monument is 555 feet high, and Mr. Covert has seen lightning strike it several times, but it is well rodded, so no harm results, but damage occurred before it was protected. The White House is also well rodded.

There is some lightning danger from a radio antenna unless it is protected by a lightning arrester or a grounding switch.

Well, my time is up, and I'll have to stop. In closing let me suggest that you write this station for a free copy of Farmers' Bulletin No. 1512-F, entitled "PROTECTION OF BUILDINGS AND FARM PROPERTY FROM LIGHTNING." This bulletin is well illustrated and full of information about rodding houses, barns, trees, radio antennae, and other objects. Good bye now until two weeks from today when I'll be back with you again with some more information about our changing weather.

--ooOoo--

CLOSING ANNOUNCEMENT: You have just listened to the regular Weather Man program which is presented from this station at this time every two weeks through the cooperation of the United States Department of Agriculture. Ob. Server Mentioned Farmers' Bulletin No.1512-F, "PROTECTION OF BUILDINGS AND FARM PROPERTY FROM LIGHTNING." Write this station for a free copy of that bulletin.

--ooO oo-

UNITED STATES DEPARTMENT OF AGRICULTURE
Radio Service

OFFICE OF INFORMATION

CHATS WITH THE WEATHER MAN Friday, March 7, 1930

Speaking Time: 10 Minutes

ANNOUNCEMENT: "How's the weather?" That question has probably started more talk in this world than any other. In talking to our old friend, Ob Server, we often vary that with "How's the Weather Bureau?" More often than not, he comes back with something new he has picked up from officials of the United States Weather Bureau------but here he is now------ Come on, Mr. Ob. Server -- tell us what's the good word from the weather men?--

*****

One of the new things in weather forecasting seems to be the fire weather truck.

Yes, sir, meteorologists in an auto, with radio and weather instruments, now dash to the scene of the big forest fires in California. As explained by Mr. E. B. Calvert, chief of the forecast division of the United States Weather Bureau, that truck is virtually a Weather Bureau on wheels. It moves into the forest to keep fire fighters in touch with weather changes.

When a big fire breaks out, in the forest, the Weather Bureau office is notified. The fire weather truck is sent rushing to the scene. By means of its radio receiving apparatus, the highly trained meteorologist in charge gets the regular reports of weather observations from other parts of the country. He charts the weather. By means of the weather instruments carried in the truck, he also makes observations of the wind direction and velocity and moisture content of the air near the forest floor in the woods in the vicinity of the fire itself. He is able to keep the director of the fire fighters constantly informed of any change in conditions which may make the fire-fighting harder or which may slow-up the fire spread. For example, if a strong wind is back of the fire forcing the flames into new timber it is highly important that fire fighters know of any shift in the wind which may be coming.

But as Mr. Calvert explains, the use of the auto truck in California is just one feature of the great fire weather warning service which has been built up in recent years by the United States Weather Bureau to help other government, state, and private agencies protect our forests from fire.

The Bureau now has seven fire weather warning district offices: One in California; one in Oregon; one in northern Idaho and Montana; one in southern Idaho; one in the Great Lakes States of Minnesota, Wisconsin, and one in the New England States, and the Adirondack region of New York.

Of course, the danger from forest fires is greatest in the Western States where high temperatures and dry weather at certain seasons make the leaves and litter on the forest floor highly inflammable. The dropping

of a burning match, a glowing cigarette butt, or a spark from a saw-mill may set up a big blaze in a few minutes which may soon burn over thousands of acres of valuable timber. The danger is multiplied many times if there are high winds. Under such conditions, the fire may get beyond control and make necessary the employment of large numbers of men and heavy expenditure of money to stop it.

If the fire occurs in a place that is hard to get to and where there are no considerable number of people, a tremendous area may be burned over before the fire is put out. But if the government and state fire wardens and forest owners can have 24 to 36 or 48 hours notice of the coming of weather which will favor the spread of fires, they can strengthen their look-outs in the danger zone and deploy their fire fighting forces to position of advantage from which they can quickly reach points where the fire is likely to break out.

Giving those advance warnings of the approach of "fire weather" is the chief work of the forest fire weather warning service in our northern and western forests, Mr. Calvert explains.

In order to be able to give such warnings, the weather experts at the fire weather district headquarters get the regular reports telegraphed from stations throughout the United States. These reports give them a broad general picture of the weather showing the location of storm centers and the advance of conditions which may make fires likely.

But those regular reports are not enough. They must be supplemented by local reports showing conditions in the forests themselves. The meteorologists must know the weather characteristics in the woods in order to forecast for any particular section. Those weather characteristics vary very much sometimes over a comparatively small area of woods; due to the differences in the forest cover and the lay of the land.

For example, in a long narrow valley the wind may be much stronger and from a different direction than over flat land a few miles away. In order to get a check on these local peculiarities, stations are located throughout the forests. These weather substations are provided with instruments to show the direction and strength of the wind, the temperature, the amount of moisture in the air, the rainfall, and so forth.

Usually, these weather stations are located where milling and lumbering is going on and at mountain look-outs and the like. As a rule, the observers are employees of the forestry services. Twice a day or oftener they report the readings of the sub-station instruments to the headquarters by telegraph. At headquarters, the reports are charted and form the basis for the special forecasts. As about one third of all the western forest fires are caused by lightning, signs of thunderstorms are watched carefully.

Warnings are sent out by telegraph, telephone, and radio, to fire wardens, to milling superintendents, and all concerned with fire protection. If the forecasts indicate fire danger, logging and sawmill operations are shut down. This not only reduces the menace of sparks from the saw-mill, but releases loggers and mill workers for fire fighting. They are assigned to positions where they will be ready to reach and fight fires quickly.

But, as Mr. Calvert points out, it is not only when the forecasts warn of danger that they are valuable. When they show little liklihood of fire, they are also of immediate practical value, because then they may indicate that logging, and milling, and slash burning can go on with the assurance that there is no particular reason for alarm.

The leaves and litter which form the cover of the forest floor are the big source of danger so the measurements of the moisture conditions near the ground are highly important. Instruments are located at most of the lumber camps and the instant the humidity goes below a fixed known danger point, precautionary measures begin.

This great system of fire weather forecasts in most of the chief forest regions of this country is just another one of the services performed by the United States Weather Bureau.

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ANNOUNCEMENT: You have just heard a brief description of the fire weather warning service as outlined by Mr. E. G. Calvert, chief of the forecast division of the United States Weather Bureau. This is one of a series of chats with the weather man presented by this Station----- in cooperation with the United States Department of Agriculture.

UNITED STATES DEPARTMENT OF AGRICULTURE

Radio Service

OFFICE OF INFORMATION

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CHATS WITH THE WEATHER MAN Friday, March 21, 1930

ANNOUNCEMENT: The weather, like the poor, we always have with us. But we don't always have a chance to sit down and hear a chat from the weather man as to the inner workings of the United States Weather Bureau. It is only every other Friday we get that. But today is the day, and our old friend, Ob. Server is here to give us a glimpse into the flood warning service of our government----------Go ahead, Mr. Ob. Server-----

******

Radio is a big boon to many folks living in the lowlands along our rivers. Mr. Montrose W. Hayes, chief of the river and flood division of the United States Weather Bureau, tells me that flood warnings broadcast by radio now reach many people who used to be cut off from communication in some of the most dangerous spots along our river bottoms.

Of course, flood forecasts are spread widely. They go out from Weather Bureau offices by telegraph and telephone. They are published by newspapers and carried by mail. But until radio broadcasting came along, there were many overflow sections which were not reached by wire or even by mail with sufficient speed to help much. They were practically cut off from the information most vital to them. Nowdays, however, the radio set enables folks in isolated sections to get this life-saving, property-protecting information as promptly as anybody.

In some valleys, homes, stores, barns, and warehouses are subject to overflow. This wonderful warning service gives the valley dwellers a chance to get themselves and their goods to safety. In other places, there is nothing much but livestock in the river bottoms. But the warnings enable owners to drive out the stock, instead of leaving them as they used to do to take refuge on high land which might be surrounded by water and finally submerged and the stock drowned.

And, of course, where there are levees. These flood forecasts are used by the levee officials in directing the patrolling and sandbagging of the levees. Power companies also use them in manipulating their water gates. In fact, there are a thousand uses. They are used in the protection of bridges. Forces of men are placed in readiness to clear away the drift which banks up against the bridge when the forecast shows flood conditions which will bring that menace. In large towns along the rivers, these flood warnings serve as indicators when to close sewers to prevent back-water flooding through the sewers and spreading disease. They show when goods need to be moved from warehouses.

These flood forecasts for the lower reaches of the big rivers are often highly accurate. An error of as much as one foot, in predicting the height of the flood, Mr. Hayes tells me, is considered quite a big miss. The forecasters are generally able to predict within three or four inches of the exact level the water will reach.

That, of course, varies with the stream. Every river and every river system is somewhat of a law unto itself. The length of time warnings can be issued before hand and the accuracy of forecasts depends on the kind of river. On the more flashy streams, running through hilly country, floods will reach a given point within 24 hours after the rains which cause them. As a rule, the larger the stream and the less the slope, the longer ahead of time warnings can be given. In the middle Mississippi Valley, forecasts in a general way can be made a week in advance of the flood. The length of time increases as we go down the river. At New Orleans, warnings cam be given a month in advance.

The accuracy of the warnings also depends on the size of the stream. For the smaller, hill country stream, warnings are made in very general terms, such as: "slight flood," or "moderate flood" or "very high flood". On the larger streams, the forecasts are expressed in more definite figures. On some streams it is possible to make an accurate forecast of the crest of the flood within a foot, while on others the forecast can be so refined that they will not vary more than two to three-tenths of a foot from the actual level reached by the water.

In very big floods on streams which have levees, however, the flood forecasts may be thrown off by breaks in a levee which may let the water flow over a vast territory. But barring such accidents, a surprisingly close estimate is made many hours in advance.

That is, it is surprising until you understand the vast system of report-gathering upon which these forecasts are based. This entire country, Mr. Hayes explains, is divided into 64 river and flood districts. Each district has a central station which gets weather reports not only for that entire district, but from other districts in a considerable area around that.

Along the rivers in these 64 districts there are some 750 river gages of one type or another spaced twenty-four hours apart by water travel. These gages show the elevation of the surface of the water in the river at that point. At the river gage stations on some of the smaller streams, the stage readings from these gages are made only when the river is rising fast or when there have been heavy rains which may produce a rise. At most of the stations on rivers throughout the country, however, readings are made every day at 8 o'clock in the morning and are telegraphed to the district center. Those not located at regular weather bureau stations are read by a local man who is given a nominal sum for each reading.

Besides these reports of the height of the water in the rivers at various points along their courses, each river and flood district center gets the regular weather reports from over two hundred stations scattered throughout the United States. In addition, the district center gets a large number of special rainfall reports from rainfall stations located at strategic points on the various watersheds.

The daiby weather reports, river stage reports, and rainfall over the area are charted and used in a mathametical formula based on past

flow, of course, varies with the stream. Every river and every given system is somewhat of a law unto itself. The length of time warning can be issued before head and the accuracy of forecasts depends on the kind of river. On the more flashy streams, running through hilly country, floods will reach a given point within 24 hours after the water first comes down. As a rule, the larger the stream and the less the slope, the longer ahead of the warning can be given. In the middle and lower reaches of the river, forecasts in a general way can be made a week in advance of the flood. The length of time in advance we go down the river. At New Orleans, warnings can be issued a month in advance.

The accuracy of the warning depends on the length of the stream. For the smaller, hilly country, the warning must be very general terms, such as: "slight rise," "moderate rise" or "very high flood". On the larger streams, the forecasts are expressed in definite figures. On some rivers it is possible to give the crest to within one-tenth of a foot from the [illegible]

records to predict what level of water will be produced by those weather conditions.

In this work, Mr. Hayes tells me, a separate formula has been worked out for each river based on what levels certain amounts of rainfall at certain stages of the river under certain conditions of run-off have produced in the past.

The chief data are obtained from the current daily reports, but the forecaster must also take into consideration the seasonal rainfall and the amount of rainfall in the ground. For instance, as Mr. Hayes pointed out, a sudden thaw in the spring may release water frozen in the ground after heavy rains the previous fall.

From his knowledge of such long-time factors, the flood forecaster can often get a good general idea of the likelihood of the river getting out of its banks long before the event.

For instance, Mr. Hayes says that conditions now indicate that a big flood on the lower Mississippi is very unlikely this year. Of course, that is, barring unusual rainfall. However, the observers and forecasters of the river and flood division keep a constant check. Engineers working on our rivers and boats plying up and down them or even tied up at the bank are interested in even small variations in the depth of the water. The river and flood service is always on the job ready to give prompt warning by radio of any menace by flood.

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ANNOUNCEMENT: Old Ob Server will be back with us two weeks from today to give us further results of his chats with the weather men at the United States Weather Bureau. These chats are presented by this Station--- in its program of cooperation with the United States Department of Agriculture of which the Weather Bureau is a part.

UNITED STATES DEPARTMENT OF AGRICULTURE

Radio Service

OFFICE OF INFORMATION

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CHATS WITH THE WEATHER MAN. FRIDAY, APRIL 4, 1930

Speaking Time: 9 Minutes.

ANNOUNCEMENT: "Whether on land, or whether on sea; we have weather, where ever we be." Today, however, is the day we hear about the work of the U. S. Weather Bureau's specialists in making this world safer from the vagaries of the weather---Our Old Ob. Server has had his usual chat with the experts and is now ready to tell us about his talk ----------

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Let me get the salt out of my eyes, and we'll have a chat about the sea. --------

Mr. E. B. Calvert, chief of the forecast division of the U. S. Weather Bureau, was telling me how much we landlubbers owe to ship masters in the way of reports as to weather conditions at sea. A lot of storms start at sea, but they don't all stay there. Many come ashore.

If you will just take a glance at a map of the globe, you'll see a big part of it is sea. Islands dotted here and there give a chance to get some reports from regular weather stations, but for the most part, we have to depend on ships sailing here and there for news about the weather over the oceans. Many ship masters cooperate with our Weather Bureau by making daily reports by radio by which our weather men keep track of storms which may hit our coasts.

Of course, ever since men first went down to the sea in ships, they have had to match their wits against the weather. Every ship captain has had to carry something of a weather Bureau under his hat. As Mr. Calvert was saying to me, our big oceangoing vessels today are almost independent of the weather so far as concerns the lives of passengers and the safety of the cargo. Bigger and better ships and the almost universal use of radio in spreading warnings of storms from one ship to another helps do that.

That set me to thinking. The U. S. Weather Bureau gets all those reports from ships at sea; but what do the ships at sea get out of it?-- what help is the U. S. Weather Bureau to ship masters?---I up and asked Mr. Calvert that question.

He pointed out, that ships often need to know what's coming from the land in the way of weather, so they can make their forecast of what they are likely to have at sea. Of course, the ships off our coasts would have a hard time getting such reports of weather in the United States if it weren't for our Weather Bureau.

But the U.S. Weather Bureau doesn't simply send ships land reports. It renders a very valuable service to mariners in collecting reports from other mariners and then consolidating and rebroadcasting them for the benefit of all. With radio, ships these days can get in touch with other ships in surrounding waters and get their reports of conditions. But if all the ships did that, Mr. Calvert explains, there would be a lot of confusion and disorder and waste of time and work in exchanging the needed tips about the tracks being taken by storms. By collecting the reports from ships at sea and distributing that information, making forecasts from it, and broadcasting warnings by radio for the benefit of marine interests on the coast and for considerable distance off the coast. The U. S. Weather Bureau is able to be of real help to even the most weather-wise of old salts.

The ships at sea transmit the weather reports to a shore radio station. The shore radio station forwards those reports to a forecast center of the Weather Bureau. The forecast center assembles the reports, combines them with reports from land weather stations, and wires them to the Naval radio stations, The Naval radio stations broadcast them to the ships.

In that way, the ship captain is furnished the needed information regularly. The Weather Bureau supplies ships which cooperate by reporting to it with base maps which the captain can use in drawing his own weather map on the basis of the reports and make his own deductions as to what the weather will be.

But the Weather Bureau also furnishes a forecast made by its own experts trained for years in this work. So that way, the skipper has available a weather specialist to help him if he wants that help. That forecast service includes advices and warnings about hurricanes and other violent storms at sea. Through its reports not only from ships but from island and coastal stations, the forecaster is able to locate the center of the storm, find out how much of a storm it is, and predict the path it will probably take. Such information is broadcast twice daily, or oftener if need be, from radio stations for the benefit of any ship which may be in threatened sections of the sea.

That kind of service, however, is not the only thing the Weather Bureau does for the men who move upon the waters. It cooperates with the Hydrographic Office of the United States Navy, in preparing weather information included in the Pilot Charts of the oceans. From many observations, made in many parts of the world, by men of many nations, the Weather Bureau experts work out the average weather conditions over the oceans, the routes taken by storms in years past, the prevailing winds, fog areas, and other weather information of interest and value to navigators of the seven seas.

Another service furnished by our weather men to those who work with them by reporting ocean weather is that of checking up on instruments used in making observations. The aim is for accuracy in reporting, Mr. Calvert points out. If there was no Weather Bureau of some such organization with which they could check their instruments, ships masters might well feel shaky as to how much they could depend on their own observations. As it is, however, ships reporting to the Bureau have the privilege when in port of comparing their instruments with standard instruments maintained at the Weather Bureau stations.

For instance, the ships must rely a great deal on their barometers for detecting the changes in air pressure which presage a storm or clearing weather. Most ships carry aneroid barometers which are more subject to inaccuracy than a mercury barometer although more suitable for use on a ship. Such instruments must be compared with a standard instrument often to keep them true, and altogether reliable.

But even when a ship is wrecked in a storm, the U. S. Weather Bureau may prove a very present help to the owners. The Bureau prepares certificates based on its records of weather conditions which are used in settling disputes over marine insurance and the like. But more ofthat next time.

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ANNOUNCEMENT: You have just listened to a chat with the Weather Man. This is one of a series which this Station presents in cooperation with the United States Department of Agriculture. These talks are made at this time ------ every other Friday.

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UNITED STATES DEPARTMENT OF AGRICULTURE

Radio Service

OFFICE OF INFORMATION

CHATS WITH THE WEATHER MAN. Friday, April 18, 1930

ANNOUNCEMENT: Here is our old friend, Ob. Server! -- He is going to tell us some more about the work of our U.S. Weather Bureau. Every two weeks, he has a little chat with the weather experts and then tells us about it. Last time, you remember, he told us something about the Bureau's forecast service to men at sea ----- Sit down, Mr. Observer? ---- What's the good word today?

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Well, whatever the weather is, it is soon gone. Some windy old salt might hang a good story on a big storm at sea last year. But I guess most you folks consider last year's weather, or last month's weather, or even last week's weather as a thing of the past. And as for the fact that on a certain day, six months ago the weather, in a certain part of the ocean, on the other side of the world, was not at all unusual ------well, you might consider that an absolutely useless thing to know.

Maybe that is because you haven't talked to Mr. F. G. Tingley, who is in charge of the Marine Division of the U. S. Weather Bureau. He could show you that past weather often has a future to it.

Mr. Tingley's division gets reports from some 1,400 ships sailing in all parts of the seven seas. Those ships take observations of the weather every day of each voyage they make. The readings of the barometer and other weather instruments are recorded day by day on a special form supplied by the U. S. Weather Bureau and then sent in at the end of the voyage or whenever convenient. The reporting ships include American, British, Dutch, German, French, Italian and others, many of which never enter a United States port. This reporting is altogether voluntary on the part of the ship-masters, U.S. Weather Bureau representatives at the various ports make arrangements for this cooperation directly with the ship masters regardless of the flag under which they sail.

From these reports, statisticians of the Bureau work out the average weather conditions at various seasons and times of the month in different parts of the oceans all over the world. From these reports, the Marine Division's experts can tell what the weather was on any day in the past in most any part of the oceans.

You might say, "What do they want to know for?"

Well, claims for insurance and salvage and the like are all the time coming up in the admiralty courts. A certificate from the Marine Division of the U.S.Weather Bureau as to what the weather was at a certain place at a certain time may often settle the case.

For instance, in one case the cargo of a sailing vessel was damaged when the ship reached port. The shippers sued for damages. They claimed the damage was due to the vessel being unseaworthy. The skipper claimed that he had run

into a tropical hurricane, so the loss was beyond his control. The records of the nearest land stations on either side of the position given by the captain did not show a tropical hurrican on that date. Through its ship reports, however, the Weather Bureau was able to testify that there really had been a small tropical hurrican in those waters at that time.

In another case a vessel carrying a cargo of coal from Europe to the United States during the coal strike a few years ago failed to reach port until after the strike had been settled. The cargo was worth very much less than it would have been had the vessel made a voyage of the usual length. A damage claim resulted and the weather records played a prominent part in the legal proceedings.

Every year a few vessels fail to reach port and are numbered among the missing ships. Some disappearances, like that of the CYCLOPS during the World War, have attracted a great deal of public attention and resulted in much speculation as to the cause of the loss. Nearly always the Weather Bureau is called upon for the record of the weather probably encountered by the missing vessel. Most ships that disappear are lost as a result of severe storms.

On the other hand, the fact that the weather was good at a certain date may be highly important in settling disputes about salvage and the like. For instance, if a ship is stranded and the salvage company works day and night to get it off and puts in a claim for overtime, as it were, the question of how much danger there was from the weather may be important to the court in fixing the amount to be allowed for salvage.

The records of the U.S. Weather Bureau are our only authoritative source of information on such past weather and their certificates are accepted as evidence by the courts. However, that is only one of the many uses of these records of the world's sea weather. Those averages worked out from these reports are published on the U.S. Hydrographic Office pilot charts of the oceans and are a general weather guide highly regarded by mariners all over the world.

One set of weatner averages, published in those monthly charts of the different oceans, shows the average number of gales each month in all parts of the seas of the world. From those records, the map of the oceans of the world has been marked off in zones of relative clamness and storminess. Those zones form the basis for part of the load-line regulations to be put into effect next September on all American ships by the U.S. Department of Commerce.

As Mr. Tingley explains, the depth at which any ship can safely be loaded is chiefly a question of the build of the ship and the weather it may encounter. Many countries already have regulations for keeping the load within the proper limits. Now the United States is going to require its ships to observe load-line rules. If the ship enters a stormy zone it will be required to carry a lighter load than is permitted in a zone of comparative calm. Many marine interests, including ship-owners, insurance companies, and shippers, will be affected in a very practical way.

So you see these records of past storms live long after the wind has died down. And they are not only valuable in settling cases at law, and in regulating shipping, but furnish the scientists data which may aid in working

out more of the ways of the weather.

One of the most violent storms on record occurred in the North Atlantic last winter, according to the Marine Division's reports. Some meterologists suspect that unusually warm water swept north in the Gulf Stream may have been largely responsible for the intensity of the storm. They think that the reports from the source of such a current might prove valuable in forecasting weather conditions far ahead. As reports of surface temperatures are included in the innumberable records from ships, many such secrets may be hidden in the files of the U.S. Weather Bureau.

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ANNOUNCEMENT: Old Ob Server has just told us something of his visit with Mr. F. G. Tingley in charge of the Marine Division of the U.S. Weather Bureau. These chats with the Weather Man are a regular feature presented every other Friday by Station ------- in cooperation with the United States Department of Agriculture.

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UNITED STATES DEPARTMENT OF AGRICULTURE

Radio Service

OFFICE OF INFORMATION

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CHATS WITH THE WEATHER MAN.

Friday, May 2, 1930

ANNOUNCEMENT: Here comes old Ob. Server breezing in! --- Well, Mr. Ob. Server, what will we get today? --- If I can read the signs right, you've had another one of your chats with the weather man. ---- Come on, let's hear about it! --- What have the specialists at the U.S. Weather Bureau to say about our old stand-by, the weather? ---

****

They tell me this is the time of the year that the tornado season begins.

Did you ever see one of those honest-to-goodness twisters? A friend of mine was sitting on a fence one day in May. He saw the clouds rushing together. He saw one of those funnel-shaped clouds dip down like a wriggling elephant's snout. It was coming toward him. But he figures it would pass on the other side of the field. He had heard that the path of a tornado is often just a matter of a few feet. He decided he would just sit steady and watch what happened. He didn't. ---- He heard the roar of what sounded like many express trains, and the next thing he knew he was picking himself up in the next field.-- He hasn't done any watchful waiting since

That is not surprising. Prof. A. J.Henry, editor of the Monthly Weather Review of the U.S. Weather Bureau, has just been telling me that a tornado doesn't lend itself to first-hand study at close quarters. It is the most violent of all whirl-winds. That funnel that seems to hang down from the bottom of a much bigger mass of clouds above, is a mere collection of clouds just like those above but swirling at a terrific rate. The funnel itself may be 50 to a few hundred feet across. The whole tornado, including the main cloud, the funnel, and the destroying winds, generally moves from southwest to northeast at a speed of 30 to 50 miles an hour; just about average cross-country automobile speed.

But that forward movement of the tornado is just one of its motions. It has three. There is that whirling motion at a terrific speed which forms that funnel. Then there is a violent updraught of air of unknown speed inside the funnel. Chickens caught in the path of the tornado sometimes come out alive, but picked clean of feathers. From what Prof. Henry tells me, the tornado seems to work pretty much like a vacuum cleaner.

But it often does a queer job of it. Here are a few well-attested bits of evidence, gathered by experts of the U.S. Weather Bureau, and entered in scientific reports on tornadoes. I say that in advance; so you won't think they were gleaned from the writing of Baron Munchausen.

In one tornado in the Middle West, a heavy lumber wagon was standing behind a corn crib. It was lifted clear off the ground, carried one hundred feet through the air over a corn-field, and let down again without hurting it in the slightest. A heavy cultivator near-by was broken up and scattered in circles all over a twelve acre field.

The old Mother Goose rhyme about the cow jumping over the moon seems the height of absurdity. Yet a cow picketed in a farm yard was actually caught up in one of the whirling currents of air, carried over the tops of trees thirty to sixty feet high and landed in a cornfield three-eighths of a mile away.

Then there was the strange case of the three-gallon tin pail. It had a cover top and was full of water. The tornado picked it up, and set it down forty-five rods away, right side up and still full of water.

Another man thought he had his carpet tacked down securely. Along came the tornado, took up the carpet, and carried it out of the house without tearing it in the slightest. An iron kettle in the same room was broken into six pieces, and a big iron-bound trunk fastened with an extra-heavy iron lock was torn to pieces and the lock was buried in a rail fence.

Cases of roofs blown off and people being lifted through the open tops of the house seem to be fairly numerous. Kitchen utensils and gutters deposited by the tornado in yards six miles from the home from which they were taken are in the record. These twisting winds turn from right to left and it just takes an average of about ten seconds for the tornado to do its dirt and pass a given point.

I say "do its dirt" because the tornado often flings mud and has been reported to have lifted water out of creeks. After one tornado, a mother washed her children for four days to get them clean and then their bodies were still covered with specks of fine dirt driven into the flesh by the force of the wind.

But that's just the more playful side of the tornado --- and you could never call a tornado playful. Most folks, who get caught in the center of a tornado, Prof. Henry tells me, never come out alive. During the last thirteen years, from ninety to nearly eight hundred people have been killed each year in this country by tornadoes and the property damage has ranged from two and a half million to over forty-three million dollars a year.

There is no telling just when and where one of these all-of-a-sudden, death-dealing whirl-winds will form and run amuck. Even our weather forecasters can't say. There are just two good things you <u>can</u> say about a tornado. One is that the swath they cut is usually very narrow -- from 100 yards to say three-eighths of a mile wide. Folks just off the tornado's path may not even know any unusual storm has happened. The other good thing about the tornado is that you can often see it coming. Prof. Henry tells me if you will run at right angles to the direction in which the storm seems to be moving, you can probably dodge it. Usually, the tornado moves from west to east. It is safer to run north than south, because the tendency is for the tornado to swing south or to its right.

If you can't get away, get down. Go to the storm cellar if there is one handy. Hug the wall on the side from which the twister is coming. If there is no protection below ground, get in any depression you can find. Lie flat, face down. Hold on to anything handy.

We usually think of a tornado as a local storm. Its length varies from a few miles up to 200 or more, however, and Prof. Henry says it is really part of a big general circular storm. It usually happens in the southeast quarter of the general circular storm, and is caused by cold winds from the north coming in contact with currents of hot air from the south. The exact position of these sharply different-temperatured air currents, when they meet, is a bit uncertain even to the experts. What happens is certain. A terrific eddy of hot and cold air is set up which sweeps down and forward spreading destruction in its path. May you all always dodge it.

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ANNOUNCEMENT: Whew! That was some wind! ---- And old Ob. Server will be back two weeks from today to give us another of his chats with the weather man at the United States weather Bureau. This feature is presented by this Station ------ in cooperation with the United States Department of Agriculture.

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If you can't get away, get down. Go to the storm cellar if there is one handy. Stay away from the side from which the twister is coming. If there is no protection below ground, get in any depression you can find. Lie flat, face down. Hold on to anything handy.

We usually think of a tornado as a local storm. It is usually only a few miles up to 500 or more, however, and is really part of a big general circular storm, many times [illegible] the diameter of the general circular storm, and in connection with it are the earth, cooler, in contact with currents of hot air from the south. The warm [illegible] is not [illegible] simply different-temperatured air currents; when they [illegible] a big mountain range to the westward. What happens is partly [illegible] of how much air is set [illegible] the cooler down and [illegible] the warm air is forced up. It rushes. [illegible] air is forced up.

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CHATS WITH THE WEATHER MAN

Friday, May 16, 1930.

ANNOUNCEMENT: This is our day for a chat with the weather man. Old Ob. Server is here to tell us what he has picked up from the scientists of the U. S. Weather Bureau.-----Tell us about it, Mr. OB. Server. We always have weather, Good or bad, we have it morning, noon, and night. We have it from dark to dawn and from sunup to sunset ----------

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Speaking of sunsets, did you see that wonder the other day? It was glorious!! As the colors faded out in the sky, I thought of the words of the poet:

"What magic shall solve us the secret
Of beauty that's born for an hour?"

But that was nothing to some of those sunsets we had in 1912. Maybe you remember them, too. The sunset colors were extra brilliant then. The usual faint second glow came back bright. It seemed as if some giant master artist had painted the western sky in a flaming burst of wild genius.

And from what Dr. Herbert H. Kimball, the sunlight expert of the U. S. Weather Bureau, tells me, that isn't so far from the truth. A giant did help paint those pictures. Those extra bright sunsets all over the world at that time were caused by smoke and ashes thrown into the upper air by the Katmai volcano in Alaska, in its gigantic explosion that year.

Back in August 1883 there was a still more violent volcanic explosion of the famous Krakatoa in the East Indies. The ashes from that big blow-up spread around the world and hung in the upper air for more than two years, causing remarkable red sunsets during '83, '84, and '85. When Mt. Pelee in the West Indies erupted in 1902 people in distant parts of the world were again treated to a series of more striking sunsets. In fact, such things seem to happen about once every ten years. It has been eighteen years now since the sunsets of 1912. Dr. Kimball says that this is the longest clear spell we've had since we began to record intensity of the visible and invisible rays we get from the sun.

You see those tremendous volcanic explosions do more than merely tinge our sunsets with extra beauty. Records of the measurements made in this country, and in England, France, Russia, Switzerland, Poland, India, and other parts of the world, show that following the big volcanic eruptions of Krakatoa, Pelee, and Katmai, there was a big drop in the amount of total radiation we got from the sun. The amount of light, heat, and health-giving rays was cut down by the practically invisible screen of volcanic ashes hanging in the upper air. Dr. Kimball, who worked out the figures which showed this remarkable shutting down of our sun-supplies, says that the average person hardly noticed

the difference. To the untrained eye, the sky just looked a little whiter.

As he explains it, what happens is that these tremendous volcanic explosions hurl very fine ashes fifty miles or more above the earth. Far above the highest clouds and above the storms these billions of very light glassy particles of microscopic size settle very, very slowly. They hang as a fog in the upper air. This excess of very fine particles in the upper air increases the intensity of the sunset colors.

Too much dust in the lower air, however, cuts down the brightness of sunsets, and even blots them out. The smoke and dust particles down here near earth don't stay up as long as the very light volcanic ash particles of the upper air. Once about every ten years we get that pronounced fogging of the upper air. Every day we get those bigger particles thrown from our chimneys into the lower air. That dust and smoke nearer earth here also cuts off from us some of the sun's rays, including the invisible ultra-violet rays doctors tell us are so important for our health.

Dr. Kimball and his division of the U. S. Weather Bureau are now measuring the sun's rays of all kinds as they filter through our city smoke. From measurements already made, it is clear that this smoke screen blocks out much of sunlight, and other rays, especially the ultra-violet. In the winter time, Chicago gets little more than half the amount of radiation received at Madison, Wisconsin, a short distance to the north. Even in the summer months, fifteen per cent less radiation filters through the Chicago air than reaches the earth at Madison.

All this time we've been talking about all the sun's rays, those you can see and those you can't. Most of us talking about the sun's rays think of those you can see, those we call "light". Dr. Kimball and his men have made important studies in that narrower range of wave-lengths.

"What size windows should we have? How many windows does a school-room need? Just how much light can we get in north windows, in east or west or south windows from the sky alone? Architects and illuminating engineers now have tables to readily determine those things. They got them from the calculations made from the sunlight and skylight measurements of the U. S. Weather Bureau. That is just another one of those services credited to our weather experts.

We get a great deal of light from an average cloudy sky. But we get nearly four times as much light from the sun and sky combined when there are no clouds, and when it rains, the light is only about half as strong as it is from a cloudy sky from which no rain is falling.

Moisture in the air even on a clear day seems to have a decided effect on the amount of ultra-violet radiation which reaches us. But the ultra-violet rays in sunlight increase fast the higher we get above sea-level. The water-vapor in the lower air layers seems to screen out much of that health-promoting part of the sunshine. It is on high mountains that we get the greatest effect from the ultra-violet, Dr. Kimball's measurements show.

So you see, whether the question is one involving the smoke from our city chimneys, or one having to do with the proper lighting of our homes, and offices, and factories, and workshops and public buildings, we have been helped toward a solution by the Solar Radiation Investigations of the U.S. Weather Bureau. Yes, even if it is a question of where to go for a vacation, we may get some light from such studies. These measurements of the amount and kind and quality of the light are going on all the time. Much is yet to be learned.

As we were saying awhile ago, a little extra brilliance in a sunset may be due to causes which reach around the world and for many miles into the alternated upper layers of the atmosphere.

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ANNOUNCEMENT: Be sure to be back two weeks from today, Mr. Ob. Server! We want another chat with the weather man at that time. ----- As our regular audience knows, this feature is presented by Station ----- in cooperation with the United States Department of Agriculture.

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UNITED STATES DEPARTMENT OF AGRICULTURE

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CHATS WITH THE WEATHER MAN. RELEASE Friday, May 30, 1930.

ANNOUNCEMENT: Come right in, Mr. Ob. Server! —— Sit right down. Tell us more about the work of the U. S. Weather Bureau. Our folks have been expecting you. They count on you being here to chat with them once every two weeks; so start right in. —— Where have you been, since last time?————

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Well, I've been talking with Mr. J. B. Kincer. He has been telling me about how Uncle Sam keeps us posted on the effect of the weather on the crops. Mr. Kincer is in charge of the Division of Agricultural Meteorology of the U. S. Weather Bureau. That is the Division which collects the crop weather reports from all over and gets us the last minute word as to what the weather has been.

That's a mighty important service too. Of course, everybody knows what kind of weather he has just had in his neighborhood. But how about the other fellows growing the same kind of crops? What kind of weather did they have?

If we didn't have some way of getting a reliable and accurate picture of what the weather affecting crops has been, rumors would be rife. False reports might be started by unscrupulous speculators. Market prices for farm stuff might be forced down without real cause. Mr. Kincer says that one of the main purposes of crop weather services is to stabalize the market by forestalling any rumors which may get abroad.

True, the regular monthly Crop Reports issued by the U. S. Department of Agriculture serve that end. But these daily and weekly reports of crop weather fill in between those regular crop-condition reports and forestall false rumors which might otherwise disturb the market in between time. You know a whole lot can happen to your crops during a long critical growing month.

Mr. Kincer tells me the Weather Bureau has two of these services for keeping farmers and others informed about weather conditions as they affect farming. One is a daily wire service. The other is the once a week Crop and Weather report covering the weather for the past week over the entire country.

The daily service is maintained during the growing season in the Grain and Cotton regions. The Corn and Wheat section is divided into thirteen districts and the Cotton Belt is also divided into thirteen districts. Each morning in addition to the regular Weather Bureau reports, each of the district centers gets special telegrams giving the details as to rainfall, and temperature, and the like from a special corps of observers scattered through each district.

Those observers are local men, who have been equipped with standard weather instruments. There are about 500 of them in the Grain and Cotton

Regions, who cooperate with the Weather Bureau in this way. They have to make an observation each day and file a telegram. They are paid twenty-five cents for each observation.

Those observations merely supply the detailed figures as to actual weather conditions. The effect of the weather on the chief crops in all parts of the country is noted in the summaries given in the other service called the Weekly Weather and Crop Service. The machinery for getting out that highly-important weekly service is even more interesting. Mr. Kincer says the chief feature of it is its up-to-dateness. It is the last minute word on what the weather has been during the past week, as reported by a large number of Weather-Crop correspondents in each State.

A Weather-Crop correspondent on a farm in the Middle West or on the Pacific Coast will note whether the weather has been favorable or unfavorable, in his section, too wet or too dry, during the past week. He will mark the post-card he has been given for that purpose and drop it in the mail Monday afternoon. The information on that post-card will be combined with that on thousands of other post-cards from thousands of other weather-crop-correspondents. The whole will be summarized, and printed, and given out in printed form at the headquarters of the U. S. Weather Bureau at Washington, D. C. at ten o'clock sharp Wednesday morning.

Of course, such speed wouldn't be possible if the cards were mailed direct to Washington. These crop weather reports are summarized and the summaries relayed to the central office from various State centers by telegraph. The State centers also publish the summary of the weeks weather and its effect on crops in that State made up in somewhat greater detail from these same post-card reports.

There are different cards for different parts of the country, because the crops in different parts are different. What the weather of the week did for or against the wheat or corn or oats or cabbage or what not is checked on the cards. If the farmer correspondent cooperating in this work is too far away from the State center for his card mailed Monday afternoon to reach the central Weather Bureau station of the State over night, he is instructed to mail to the nearest weather bureau station, from where a summary is sent to the State center by wire. All the reports showing conditions up to Monday afternoon must be in the State early Tuesday morning.

Each State or section center then must make a summary for the entire State and forward it to the central office at Washington by wire. It must be in Washington not later than Tuesday noon. Some section centers have up to 1500 Weather-Crop correspondents to supply a complete picture of weather in the State.

The weather-crop correspondents make their reports free of charge. They get nothing for their trouble. The whole service is on a cooperative basis, Mr. Kincer says.

But while these reports give a complete picture of the weather as it has affected crops in this country that is not the whole story. To complete the picture, the Weather Bureau exchanges information with meterological

services of Argentina, Canada, England, India, and Australia during the growing season in those countries which produce crops in competition with ours. Those government weather services swap crop-weather with our Weather Bureau, and their reports are included in the Weekly Crop and Weather Reports issued each Wednesday at Washington. This gives an up to the minute birds eye view, as it were, of weather and crop conditions for most of the principal agricultural countries of the world.

So you see it takes quite an elaborate system of information to keep down wild weather talk which might up-set markets and hurt prices.

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ANNOUNCEMENT: You have just listened to the regular chat with the weather man presented by Station_____. These chats are presented by this Station in cooperation with the United States Department of Agriculture. Tune in on another of these talks two weeks from today.

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CHAT WITH THE WEATHER MAN: RELEASE Friday, June 13, 1930.

ANNOUNCEMENT: We our now ready for our bi-weekly chat with the weather man. Our old Ob. Server visits with the scientists of the United States Bureau, and then passes on to us what they tell him.------ Here he comes now------ Hail! old Ob. Server! ---------

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All hail, folks! ------
You've all heard a lot of hard stories about hail stones.

Hail-stones as big as hickory-nuts, or even as big as hens' eggs, break into the papers from time to time. When the stones reported are much bigger than that, most of us are inclined to take the stories with a grain of salt. Naturally, the salt melts the ice down, so we can swallow the hail-stones.

However, I've been looking through some of the records at the United States Weather Bureau. There are well-authenticated instances of hail-stones, not only as big as hens' eggs; but as big as base-balls, and even as big as grape-fruit.

For instance, four years ago, there was a big hail storm at Dallas, Texas, in which many of the pellets of ice were as big as base balls. Some were reported as two to four inches in diameter. They weighed as much as twenty-two ounces. Scores of people were injured and horses were said to have been killed.

However, the storm at Potter, Nebraska, two years ago seems to hold the world's record. Out of that shower of ice in chunks as big as grape-fruit came one which measured seventeen inches in circumference and weighed a pound and a half; according to the sworn statement of the man who did the measuring. It was smooth, clear ice. When he cut into it, he found it was formed of several distinct layers of ice around a common center. You may have noticed that is generally the case with hail-stones. They have a number of concentric layers; often a layer of hard clear ice and then a layer of soft, snowny ice.

Mr. J. B. Kincer, in charge of the Weather Bureau's Division of Agricultural Meterology, who was telling me about hail, says those concentric layers show the up-and-downs in the life of a hail-stone.

Maybe you have wondered why we have showers of ice in hot weather? Hail is distinctly a hot weather proposition. You may have noticed, it usuall comes with a thunderstorm. As Mr. Kincer says, thunderstorms always have a strong upward wind or current of warm air. That big updraught catches up

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rain-drops and carries them far up into the colder air where it is cold enough to freeze them into balls of ice.

They start falling! They reach the warmer air and more water collects around the ice. They they may again be caught up by the rising air-current and carried swiftly up to freezing heights. They may make several up and down trips, adding a layer each trip, until they get too heavy and drop to earth as hail.

That is just the opposite from the way sleet is formed in the winter-time. Those tight little pellets of hard ice we call sleet, are formed by drops of water in warmer upper air freezing as they fall through the cold lower layers of air.

Hail storms are one of our most erratic, irregular types of storm. Whether hail forms is largely a question of whether or not the up-current of warm air is strong enough. That is why hail usually comes with a severe thunderstorm. It is formed only when thunderstorms are at their height.

Such a strong up-movement of air, much like a fire in a chimney, usually covers very little country at a time. There may be a severe hail storm on one farm while the farm next to it is untouched by the ice. Usually, the fall of ice lasts only a few minutes. The thunderstorm sweeps on, probably at the rate of from thirty to forty miles an hour, and carries the narrow draft of warm air with it.

A hail storm may be gone but not forgotten. Hail-stones so big and storms so severe as to kill animals and injure people are rare. But the damage done to farm crops by even a moderate hail storm is considerable.

The United States Weather Bureau collects and publishes the number of hail storms reported throughout the country. The damage done to various crops is also estimated. Of course, Mr. Kincer says, these are merely rough estimates. It is practically impossible to determine the damage exactly.

However, in a severe hail-storm year, the total damage done by hail to corn alone has been estimated at 34,000,000 bushels. That year hail reduced the yield by nearly one and a half per cent.

Wheat damaged during a heavy hailstorm season has amounted to about two per cent of the total crop or seventeen million bushels. That doesn't seem such a large percentage, But when you recall how local and how spotted hail storms are, you realize that means tremendously heavy damage in some regions --- sometimes even total loss of the crop for some farmers. For example, a loss like this for a single season is equal to the destruction of the entire wheat crop of more than one thousand farmers if their crops should average one hundred acres each.

The hail often comes just before wheat harvest and the flails of ice shatter the heads and beat out the grain. In the case of corn, the damage often seems to be harder to estimate but no less real. The South Dakota Experiment Station made what you might call an artificial hail storm. That

is they tore leaf blades and broke corn plants in initation of the way they are damaged in hail storms. Other plants were left undamaged for purposes of comparison. Plants that had all the leaf blades stripped off produced a little over two bushels to the acre as compared with twenty bushels to the acre from the undamaged plants. The most critical time for a hail storm to strike corn is in the period from tasseling to kernel formation, the South Dakota experiments seemed to show. Damage at that time reduced yields most.

Some years, Mr. Kincer says, hail storms are rather evenly distributed over the country. Other years, they may be bunched in a few states. As a rule, practically no hailstorms take place on the Pacific Coast and very few in the Gulf Coast country. The records show that the upper Mississippi Valley and Great Plains States have the biggest number of hail storms. But even in that region hailstorms vary greatly from year to year. In 1928, there were an unusually large number in Michigan, and Kansas, and northeast over Missouri and also in Montana.

However, there is nothing that we can do to stop them or control them or very little we can do to protect our crops from them, Yet the U. S. Weather Bureau seeks reports of any hailstorms which may happen. By charting the number of hailstorms, in different sections of the country, the Weather Bureau gives valuable help to both farmers and insurance companies; in giving them a fair basis for estimating the cost of the risk in hail insurance in differen regions.

Then too, if it is weather, the U. S. Weather Bureau watches it. The more information on all phases of the weather we have, the better position our scientists will be in to solve some of the weather's yet baffling secrets.

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ANNOUNCEMENT: Hail and Farewell to old Ob. Server until this two weeks from today. These chats with the weather man are presented by Station ——— in cooperation with the United States Department of Agriculture of which the U. S. Weather Bureau is a part.

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CHATS WITH THE WEATHER MAN. Friday, June 27, 1930.

ANNOUNCEMENT: Two red flags with black centers, flown one above the other, is the U. S. Weather Bureau signal a hurricane is coming. We are not going to run up those flags. We just want to warn you. Here comes old Ob. Server. From the way he is breezing in, he must have a gale on his mind, at least; if not something stronger. --------Well, Ob. What's new in weather, this time? ----------

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More and better weather reports! -----

That seems to be the motto of the U. S. Weather Bureau.

Right now, the prospects look good for our getting reports direct from the 'home of the hurricanes.'

Mr. Charles L. Mitchell, the hurricane expert, has just been telling me about this most recent development.

It seems those terrible tropical blows which sometimes hit our South Atlantic and Gulf States in the summertime come a long way. We call them West Indian hurricanes. But Mr. Mitchell has been going through old weather reports from ships. He has traced most of the big hurricanes of the past to their starting points. He has found that they generally start near the Cape Verde Islands, just a little way off the west coast of Africa.

Portugal owns those islands, and maintains two weather reporting stations and one short wave radio station there. Now, the Weather Bureau hopes to make arrangements by which we can get weather reports from the Cape Verde islands, from which our forecasters can detect the very beginning of tropical cyclones which may strike our coast a few days later.

The Cape Verde Islands ordinarily have a very even temperature, the direction and speed of the wind there is remarkably uniform. There are no rains during the greater part of the year. When any little change happens near the Cape Verde Islands, Mr. Mitchell says, it is time to watch out. A hurricane may be starting west on a rampage, swinging a little to the north as it goes.

Ordinarily, we don't get word of a hurricane until it gets near the Windward Islands in the West Indies. That is plenty of time, for warning folks in the Gulf States or the South Atlantic coast. The winds which form these great wirlwinds blow at a terrific rate around the center of the storm, but the storm as a whole travels forward in low gear, as it were.

However, for our folks in Porto Rico and some of the other outlying islands, radio weather reports from the Cape Verde Islands off Africa will

be a big help. Those reports made possible by Portugal will also increase the area of observation for our weather men. They may add much to our knowledge of the ways of hurricanes in general.

Once a tropical cyclone gets near the West Indies, it has to run the gantlet of Weather Bureau stations located on nearly every important island in the great chain of islands extending from Florida to South America.

Besides these fixed stations from Trinidad and Barbadoes to the big islands of Haiti, and Jamaico, and Cuba, many ships plying the waters of the Caribbean send in regular weather reports.

From all these reports the forecasters can locate the center of the hurricane, and plot the direction and rate at which it is moving.

The least air pressure and the strongest winds are recorded by weather instruments nearer the center of the hurricane. That often makes it easy to locate the heart of the hurricane from a very few reports, and sometimes from a single report.

Predicting the exact path this terrific whirlwind will take as it slowly moves on its destructive way is not so easy. Figuring out the curves the path of a tropical cyclone will make, Mr. Mitchell tells me is an agonizing job.

We know in a general way that most of our so-called West Indian hurricanes move west-northwest and then generally recurve to the north and east. But each storm path is different. Just where or when, the cyclone will change its direction depends on the conditions it meets at the time. The forecaster must be armed not only with the facts in the region of the storm itself, but must have before him the weather map showing what is ahead of the storm, and what will be ahead twelve to forty-eight hours after he makes the forecast.

As we said, a hurricane ordinarily travels west-northwest then swings north and east. Last year, however, one of these highly individual cyclones was moving along in the orthodox way. Then it turned in its tracks and went southwest through the straits of Florida. That was something no hurricane was ever known to do before. To make matters worse for the forecaster, the wireless station at Nassau went down in the storm, and there were no other reports from near the center of the big blow. The forecasters had to practically feel their way to the probable path of that erratic hurricane in order to warn people who might be in the way. There were no ship reports to be had. Although the Weather Bureau gets regular reports from a great many ships, when the hurricane is in progress, there are very few ships near the storm path, to report. Most of them take warning from the forecasts and either stay in port or change their courses so as to dodge the storm.

One of the big difficulties often faced by the forecaster is in not having enough reports. That is especially true in cases where the hurricane

keeps on going west into the western Caribbean Sea before it swings north. After the storm passes through that chain of stations in the eastern Caribbean, it is harder to follow. There are fewer island or land stations west of Cuba by which to map its movement.

The big hurricane months are June to October, with most of them starting from the Cape Verde Islands in August. In fact, Mr. Mitchell has found that no tropical cyclone of hurricane intensity has ever reached our Gulf or South Atlantic coast in any of the other seven months of the year.

And it is interesting and important to note that no State has an average of one hurricane a year. But, as we all know, one hurricane can spread a lot of death and destruction in its path. Warnings sent out by the U.S. Weather Bureau from twelve to forty-eight hours in advance, however, enable many to get themselves and their goods to places of safety. Much of the loss of life often comes from folks just "taking a chance" in spite of warnings. Other unnecessary losses come from failure to build houses strong enough to stand the pressure when the wind gets up to 100 to 125 miles an hour. Few well-constructed buildings collapse in a hurricane. The flimsy ones are the dangerous ones.

However, as our exposed southern coast is fast growing in population, and more houses are built, and more ships ply the waters nearby, the great hurricane warning system of the U. S. Weather Bureau is becoming increasingly important. Each hurricane's path must of necessity be forecast on the basis of reports of conditions at the time. The responsibilities are tremendous. As Mr. Mitchell says, the hurricane forecaster doesn't occupy any bed of roses.

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ANNOUNCEMENT: Let's hope that any hurricane which starts our way will spend its energy in rain before it hits us. We want to be on hand to get these chats with the weather man. They come once every two weeks. In presenting them, Station_____is cooperating with the United States Department of Agriculture.

UNITED STATES DEPARTMENT OF AGRICULTURE

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CHATS WITH THE WEATHER MAN. Friday, July 11, 1930.

ANNOUNCEMENT: Our old friend, Ob. Server has been chatting with the experts of the United States Weather Bureau again. Often, at this time of the year, weather is a sort of a dry subject. However, old Ob. Server promises us, that what he is going to tell us, won't be that way. Neither will it be all wet. ---------- Go ahead, Mr. Ob. Server. Make good that promise.

* * * * *

What is a good rain worth?

What is a good rain, say a one inch rain, after a long dry spell, worth to farmers?

Every once in a while, when there has been a severe drought, and then a rain comes just in the nick of time to save the crops, the papers blossom forth with big headlines about the "million dollar rain."

During this last spring, rain was needed rather badly for a long time in most States east of the Mississippi River. Mr. J. B. Kincer tells me that set him to figuring just what a good rain is really worth. Mr. Kincer, you know, is in charge of the United States Weather Bureau's division of agricultural meteorology. The crops and weather are his two chief worries. Or his one main worry.

Now you might think that it would be practically impossible to put a price on the rain. But Mr. Kincer says it is not so hard as it may seem.

To begin with, we know that when a season is very droughty, many crops are short. When there is plenty of moisture, they are, as a rule, comparatively large.

The Weather Bureau has the records of rainfall for all our States, from month to month, during the growing season. We also have the records of crop yields. With those figures to work with, Mr. Kincer says, it was comparatively easy for him to figure out just about how much one inch of rainfall means toward bigger crops. That is especially true for crops that demand plenty of moisture during critical periods of growth. For instance, it is true for hay in the springtime and corn during the heat of the summer.

Now, as Mr. Kincer puts it, armed with the proper records, we set out, as it were, to bag our million dollar rain. As a starting place for his hunt, Mr. Kincer selected the great farming state of Kansas. He made a sort of statistical search to find the relation of rainfall to corn production in Kansas.

We won't go through all the figures he set down with pencil on tablet. But here is the result in one step. He found that each inch of rainfall in Kansas

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from June to August means two and two-tenths bushels of corn to the acre. That is, with an increase of one inch of rainfall there is an increase in corn yield of two and two-tenths bushels to the acre. At least, that has been true for the past twenty years.

--- And, we might say right here, that one inch of rainfall is just about the amount you get in one good substantial rain. Remember, one good rain means about two and two-tenths more bushels of corn to the acre.

Now, for the last ten years, Kansas farmers have grown, on the average, about five and a half million acres of corn. Just multiply that amount by two and two-tenths, and you see that one inch of rain may mean twelve million bushels more corn in Kansas, and figuring that according to the average farm price of corn during the last ten years, Mr. Kincer says we find that such a one-inch rain all over Kansas would mean not a "million dollar rain", but an "eight million dollar rain." And Kansas is just one of the 48 states in this great agricultural country of ours.

Take North Dakota. Mr. Kincer worked that same system of figuring on some half dozen North Dakota crops. Using the rainfall records from May to July, just as he did in Kansas, he found that one inch of rainfall in North Dakota produces about six million bushels of oats; nearly three million bushels of barley; nearly one million bushels of potatoes; more than a half million bushels of flax seed; about nine million bushels of wheat; and more than one-hundred and twenty-five thousand tons of hay; to say nothing of truck, garden and other crops.

Computing on the basis of average prices for the last ten years, he found that one good rain in North Dakota, any time from May to August, has been worth the neat little sum of seventeen million dollars to the farmers of North Dakota on those six crops alone.

Knowing that rainfall during May and June is especially desirable for hay in the northern half of the United States, he figured what an inch of rainfall is worth at that time, in hay production, over the entire area from the Dakotas, Nebraska, and Kansas eastward to the Atlantic Ocean. There he ran into big money! He found that, on the average for the last twenty years, one inch of rain has increased hay yields in that territory by 264 pounds to the acre. At the average price of hay and with the average acreage for the past ten years, that would mean the tidy sum of seventy-seven million dollars as the value of one inch of rain to the hay crop alone. "You see," Mr. Kincer said to me, "It is not hard to bag a million dollar rain."

"I didn't know an inch of rain amounted to so much," I remarked.

"An inch of rainfall is more than you might think," Mr. Kincer replied. "Take the case of Kansas. One inch of rainfall all over Kansas would mean five billion five hundred million tons of water."

"Those are too big figures for me to handle, "Is there any other way you can put it --- so it will mean more to me?" I asked.

"Well, suppose you could count water at the rate of one hundred and fifty tons a minute, sixty minutes an hour, and twenty-four hours a day?" explained Mr. Kincer. "How long do you suppose it would take to count that one inch of rainfall in Kansas?"

[illegible] August [illegible] two-tenths [illegible] return to [illegible]. [illegible] with an increase of [illegible] inch of rainfall [illegible] [illegible] two and two-tenths [illegible] to the zone. At [illegible] [illegible] twenty years.

--- And, we might say right here, that [illegible] inch of [illegible] in one good substantial rain. [illegible] two-tenths more [illegible] acre.

[illegible] the last ten years, Kansas [illegible] about five and a half million acres of corn. [illegible] two-thirds more, and you see that one inch of [illegible] corn in Kansas, and figuring [illegible] during the last ten years, Mr. Kinzer [illegible] over Kansas would mean [illegible] dollar crop." And Kansas [illegible] at [illegible] acre.

[illegible] Dakota. Mr. Kinzer worked [illegible] all I see Mrs. Dakota crops. Using the [illegible] he found that one inch [illegible] bushels of oats; nearly [illegible] of potatoes; more than [illegible] of wheat; and more [illegible] tobacco.

[illegible] the basis of average prices for the last [illegible] rain in North Dakota, any time from May to August, [illegible] the sum of seventeen million dollars to the farmers [illegible] crops alone.

[illegible] that rainfall during May and June [illegible] half of the United States, he figured [illegible] production, over [illegible] to the Atlantic [illegible] for the average for the last [illegible] in that territory by [illegible] with the average [illegible] seventy-seven [illegible] alone. "You see," [illegible] how much rain."

"I [illegible] an inch of rain [illegible]

[illegible] rainfall is more than [illegible] "Take [illegible] Kansas. One inch of rain [illegible] billion [illegible] hundred billion tons of water."

"That's too big figures for me to [illegible]," [illegible] can put it --- so it will mean more to me?" I [illegible]

"I [illegible] suppose you could [illegible] one [illegible] acre. "How [illegible] do you suppose it would [illegible] Kansas?"

I saw I was not going to be able to figure that one out in my head, so I started to reach for my pencil.

"Don't try it," he cautioned. Counting 150 tons to the minute, without stopping day or night, for 365 days in the year, it would take you seventy-five years to count the water in one-inch of rainfall all over Kansas."

"Just in the one State of Kansas?" I gasped.

"In one good rain," he repeated.

"And you say that it sometimes gets pretty dry in Kansas.

ANNOUNCEMENT: Whew! That was some rain? --- one good substantial rain! And now then, Station ------- and the United States Department of Agriculture will have old Ob. Server back with us two weeks from today to give us another chat with the weather man.

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[illegible] figure that one out in a hurry, so I [illegible] pencil.

"Don't try it," he [illegible]. Counting [illegible] [illegible] day or night, for 365 days in the year, it [illegible] [illegible] would take the water in [illegible] of millions of [illegible] [illegible]."

"Sure is the one thing [illegible]" I [illegible].

"I [illegible] [illegible] main," he [illegible].

"A[illegible] [illegible] [illegible] [

UNITED STATES DEPARTMENT OF AGRICULTURE
Radio Service
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CHATS WITH THE WEATHER MAN. Friday, July 25, 1930.

ANNOUNCEMENT: We told our old friend, Ob Server, we would let him give his usual "chat with the weather man" if he would promise not to say anything about how hot it has been. He agreed to give us something cool to think about.-- Here he is, fresh from his talk with the experts of the United States Weather Bureau. Well, Mr. Ob. Server-------

******

Let's stay cool about this.

We might start off this weather talk, with a tall frosty glass of fruit ade.

If you could talk, as I did, with Mr. Floyd D. Young, of the Fruit Frost Service, of the United States Weather Bureau, you'd realize that the supply of citrus and other fruits we have for use in the summertime may be fixed by the frost.

Mr. Young, of the Frost Warning Service, has his headquarters in the fall and winter at Pomona, California, in the orange and lemon growing region. In the spring, he shifts North to help take care of the pears, and peaches, and apples, and apricots of northern California, Oregon, and Washington. Recently, the Weather Bureau has set up a station at Mobile, Alabama, to test out the possibilities of a similar frost warning service for our Gulf Coast.

This frost service of the U. S. Weather Bureau, Mr. Young points out, affects others of us beside those who grow the fruit. When you know that one big freeze a few years back took over half the citrus crop in California, you begin to understand how important this matter of frost may be to all consumers of oranges and lemons, for instance. It may not only cause a loss of at least fifty million dollars to the growers, but may cut the supply and raise the prices to all of us.

As Mr. Young says, frost hits everybody sooner or later and sometimes causes an actual catastrophe. The horticulturist is worst hit. Other farmers may make a new crop, when one is killed; or, they may move out and leave the land until time for the next crop. When the orchard crop is killed off, the orchardist still has his orchard to take care of. For that reason, horticulturists have been keener about fighting frost than most other farmers.

Old Pliny, way back in 77 A. D. advised the grape growers around Rome to build straw fires in their vineyards to keep off the frost. His idea was that the smoke would protect the vineyards from frost. The temperature doesn't fall in a fog. The fog prevents loss of heat from the ground. That old Roman naturalist figured that smoke would do the same thing.

*****

In fact, that smoky-orchard idea rolled right on down the ages. It arose amid the orchards of southern California, after several bad freezes, some forty years ago. Those orchardists burned coal in heavy wire baskets between the trees and got fair results.

About 1912 they began to raise a real smoke. They started using oil in open pans and water pails and tin cans. In fact, Mr. Young says, they pretty well smudged up the whole countryside. In the freezes of 1913, they did save a good deal of the crop and that stimulated interest in frost protection. Better types oil heaters were made with a closed bowl and a small stack. The idea was still to raise a big smoke. The oil they used was just as it came from the well. It had asphaltum in it and that clogged up the stoves in a little while. It had water in it, and that caused explosions and other troubles. In the face of all the troubles, the use of orchard heaters declined steadily after 1913. In 1917, however, in cooperation with the growers' associations, the U. S. Weather Bureau planned to solve this frost protection problem on a business basis and find some way to give more accurate warnings when frost would occur.

The first thing the investigators did, Mr. Young recalls, was to get the growers to bring in their thermometers for testing. They brought them; all sizes and shapes of them. Many of them were from two to fifteen degrees off. It was plain that such thermometers would prevent growers knowing when to light their heaters for protection.

Through the farmers' cooperatives and the manufacturers, a standard orchard thermometer, accurate within half a degree, and easy to read with poor eyesight, was developed.

A second line of investigation was started to find just what gave the protection. Very careful measurements were made of heat losses from groves under smoke cover. It was found that extra dense smoke does have some effect; but very little. Natural gas was then piped into an orchard. It was heated without smoke, and checked with an orchard heated by smoky oil heaters. It was found that heat and not the smoke did the work. The discovery was revolutionary. The orchardists lost in the fog of their own smoke were put on the right trail.

Knowing that they wanted heaters not smokers, new heaters and a new type of orchard heater oil was developed from refuse oil after all the kerosene and gasoline, had been taken out. The new by-product heater-oil wasted no highly valuable natural resources. It contained no asphalt and no water, so did not clog the stoves or cause other troubles as had been the case in using crude oil.

While the better thermometers, and better oil for better heaters were being developed in these cooperative investigations, Mr. Young says the weather experts were also working all the time to make accurate forecasts as to what the lowest temperature in the orchards would be. That was so the orchardists would know just when to light up their heaters so as not to waste fuel and yet not wait until the fruit was damaged.

Before that, the forecasts had been made in general terms, such as "Heavy frost on exposed places." The growers could get no real idea as

-6-

to just how serious the frost might be. However, key points were selected in the fruit districts and methods were developed by intensive investigation of local weather peculiarities, by which definite forecasts could be made, in exact figures, as to the lowest temperature which would be reached in the next eighteen to twenty-four hours.

Frost warning and frost prevention was put on a practical basis. That started an increase in the heated acreage. The orchards using heaters have increased steadily for ten years, until now Mr. Young estimates that, in the case of citrus fruits, nearly one-third of the total acreage is equipped for orchard heating.

If all the oil heaters in California orchards were burned one night and burned dry, it would take 1750 car loads of oil to refill them. That gives you a little idea of the size of this orchard heating business, built up on the frost warning service of the U. S. Weather Burea, and the fruit growers associations, which have gone fifty-fifty with the government on the expenses of these special frost investigations.

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ANNOUNCEMENT: The United States Weather Bureau certainly cleared away a lot of the smoke from frost protection. Just another of those Weather Bureau services! --- And even if old Ob. Server has had something to say about heaters, I guess the thoughts of those cool drinks and frosty weather have refreshed us a bit.---- Wonder what he will tell us about next time -----

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CHATS WITH THE WEATHER MAN. RELEASE Friday, August 8, 1930.

NOT FOR PUBLICATION

Speaking Time: 10 Minutes

ANNOUNCEMENT: And now for our chat with the weather man. Since the dawn of human life, the weather has been an important subject to man. Those of us living the most sheltered existence use it as a conversational stop-gag. But the experts of the United States Weather Bureau have evidently been telling our old friend, Ob. Server, how folks act where the weather sometimes rises to be a much livelier topic. --- You tell us about it, Mr. Ob. Server. ----

******

Yes. It is true. For some people, the weather reports seem the mildest, dullest sort of news.

That is not the case on our Southeastern and Gulf coasts, At least, not when a hurricane is coming.

Mr. I. R. Tannehill, of the Forecast Division, of the United States Weather Bureau, tells me, that at such times, the crowds around Weather Bureau offices and bulletin boards look like those during the World Series base-ball games, or the crowds getting the returns from a hotly-contested election.

Folks literally come to the Weather Bureau offices in the threatened area by thousands, Mr. Tannehill says, and the telephone calls run to a hundred thousand and oftentimes more. Many people keep maps on which they chart the path of storm as it comes on. As the hurricane gets nearer and nearer, the crowds about the bulletin boards get bigger and bigger.

Railroad and steamship and other business interests keep men at the Weather Bureau offices to keep them advised as to the progress and path of the on-coming hurricane.

You see, hurricanes are big, slow-moving storms. That fact, coupled with the fact that the Weather Bureau gets reports by radio from vessels at sea and from a number of stations scattered through the West Indies, makes it possible for the forecasters to issue warnings from two to ten days before the hurricane hits our coast. Thousands of lives and millions of dollars worth of property have been saved by those warnings.

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In fact, Mr. Tannehill says, the loss is now often greater at interior points than on the coast, because the people in the more exposed places have become hurricane-wise.

Knowing the hurricane is coming for days ahead, folks along the coast generally have plenty of time to get themselves and their goods and chattels to places of safety. Even when a hurricane appears suddenly and moves unusually fast for a hurricane, there are hours after the warning is received to protect property and seek a place of safety.

From Cape Hatteras along the South Atlantic and Gulf Coasts to Brounsville, Texas, the Weather Bureau maintains more than one hundred display stations, Those stations display regular storm warnings, as well as the comparatively rare hurricane signals. Two red flags with black centers flown one above the other is the hurricane signal by day, and three lanterns, one white between two red, hung one above the other, is the hurricane signal by night.

Mr. Tannehill was telling me of a little summer colony community of ninety frail frame houses in an exposed locality, which found itself in the path of a hurricane on comparatively short notice. As soon as he got the notice, the displayman stationed nearby raised the hurricane flag-signal over his motor-cycle and did a Paul Revere to that Colony.

The people in those frail houses responded promptly. They realized that under such circumstances the correct form of hurricane etiquette was expressed by Lady Macbeth, when she said, "Stand not upon the order of your going, but go at once." Eighty-eight of those ninety houses were completely destroyed by the hurricane. But the inhabitants had all been saved; all but two old colored people, who refused to heed the signal.

The sending of hurricane Paul Reveres by motor cycle and automobile into isolated communites is the plan followed in many cases. Warnings are also flashed to those in danger by telegraph, telephone, and radio. Newspapers publish the warning. Each Weather Bureau office maintains a list of those to be warned. In towns and cities, police and fire departments aid in spreading the news and, in many places, the chambers of commerce maintain standing committees to cooperate with the Weather Bureau in helping hurricane-proof their communities.

Steamship companies either keep boats in port, or go ahead but take advantage of the warnings broadcast by radio in directing their course, so as to minimize the danger.

Railroad companies often run special trains to carry folks and freight back from low sections to higher ground. That is especially necessary some places to avoid the so-called "tidal-wave" which Mr. Tannehill says is no tidal wave at all. The hurricane does pile up the waters of the ocean or the Gulf of Mexico in advance of its center, causing high tides in the bays, and inlets, and river mouths, and over the low coast country. But that rise of water is seldom sudden and overwhelming wall of water such as we usually

think of as a tidal wave. The rise of water is usually gradual at first. It gets to mounting faster as the center of the storm gets nearer, but there is always plenty of time for the inhabitants to move to higher ground if they heed the warning. In some small communities, trains carry practically every inhabitant away from his home to higher ground.

Other precautions taken are the boarding up of windows to keep out the wind; hustling merchandise in stores on low ground to the rooms above; removing objects from the tops of buildings when it looks as if they might be blown off and hurt somebody in the street below. When the storm gets violent the electric light is cut off to prevent electrocution by bare electric wires.

Another very important thing, folks along the southern coast country have learned and that is to build more sturdy houses, with stronger frames of heavier timber. Few houses built to withstand a hundred mile an hour wind are damaged by the average hurricane.

Livestock often presents a very troublesome problem, in a hurricane. Sometimes the damage is heavy. Mr. Tannehill mentioned one case on the coast, where the habit of cattle of running with the wind led to the loss of a herd of several hundred head. The wind changed suddenly and started blowing out to sea, and the dumb, driven brutes waded right out into the bay and were drowned. Because of the prompt precautions now taken, based on the radio report and hurricane warning system of the Weather Bureau, people along our South Atlantic and Gulf Coasts now feel much greater security from the threats of tropical storms. Not only that, but Mr. Tannehill says, the people in the interior are now beginning to take more serious heed of the Weather Bureau's hurricane warnings.

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ANNOUNCEMENT: Forewarned seems to be forearmed along our southern coast. We are warning you all right now, if you don't want to hear something interesting on the weather ---- Well, anyway, old Ob. Server will give us another chat with the weather man this time two weeks from today. These chats come to you through the cooperation of Station _____ with the United States Department of Agriculture of which the United States Weather Bureau is a part.

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CHATS WITH THE WEATHER MAN. RELEASE: Friday, August 22/30.

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ANNOUNCEMENT: After a long dry spell, there is nothing like a good refreshing rain. But did you ever stop to consider how we know how much rain we've had. Our old friend, Ob. Server has been talking with the experts of the U. S. Weather Bureau about how we measure rainfall. In that connection, he has something to say to some you folks --- Well, Mr. Ob. Server?

--ooOoo--

A lot has been SAID about the weather recently. But Mr. B. C. Kadel has been telling me something some of us could DO about the weather.

Mr. Kadel is in charge of the Instrument Division of the U. S. Weather Bureau. He seems to think that a lot of us who have the time and an interest in weather might get a lot of kick out of keeping tab on the rainfall. And we might do a real service to the country.

As he points out, in the British Isles there is a rainfall organization the members of which have measured the rainfall of the British Isles for years. They have assembled and published the results of their measurements from time to time. Mr. Kadel says there is a real need for a similar effort in this country. What's more, the need is far greater today than ever before, on account of the growing use of water for power and irrigation.

In this broad land of ours, the Weather Bureau has some five thousand regular rainfall stations. In some sections, such as the Eastern seaboard, stations are close enough to each other to give a fair idea of the general average rainfall in those sections. But in other parts of the country, especially in the less densely populated sections of the West there is real need for many more measurements than are available. Many such thinly settled sections are the source of supply of western rivers. As Mr. Kadel says, water is one of our great natural resources, and it is highly important we should have a survey of how much we have. However, he doesn't urge that the government multiply its rainfall stations, as it is a comparatively simple matter to measure the rainfall, he thinks interested individuals can do it to their own enjoyment, and the benefit of the country.

Of course, folks have been measuring rainfall for hundreds of years. The first rain gauges known to have been used were made of stone. That was over in Korea.

Nowadays, we make them out of metal. All through the world, you'll find metal cylindrical vessels with the top leveled and freely exposed to the sky for catching the rain.

The rainfall is measured on the basis of the depth of water on a level; assuming that none is lost from the time it falls until it is measured.

The custom most widely followed in this country, is to catch the water in a big vessel. Then pour the water that falls into that big vessel into a small vessel to increase its depth, so as to provide a magnified basis for measurement.

For example, Mr. Kadel says you might catch the rain in a washtub, then pour it into a one gallon straight-sided syrup can to measure it, by putting a measuring stick or foot ruler in the water. Of course, there must be a definite relationship in the sizes of the two containers. A wash-tub--- syrup can rain gauge would be too crude for accurate practical purposes.

In the regular Weather Bureau rain gauges, the smaller vessel or measuring tube is uniformly one-tenth the size of the larger vessel or container.

The U. S. Weather Bureau rain gauge consists of a metal cylindrical collector eight inches in diameter at the upper end, terminating in a funnel which directs the water into the measuring tube, the diameter of which is one tenth the diameter of the collector.

In Europe , Mr. Kadel tells me, the weather men use a similar funnel to direct the water into a glass jug. Then they measure the water by pouring it into a glass graduate. In some cases, the amount of water is determined by weighing. Ordinarily, however, the weighing method is limited to measuring snow.

And right there, it is well to remember that measuring the water content of snow is a subject closely allied to rainfall measurement. The snowfall which lies in the mountains, feeds the headwaters of many rivers. Measuring that snowfall, Mr. Kadel says, is a problem on which only a beginning has yet been made. Enough has been done, however, he declares, to show that it is practical to appraise the quantity of water available for power and irrigation well in advance of the time it will be used. -----

That is quite another question. - Let's get back to our rain gauge. As we were saying, when it is impossible to make measurements immediately after rainfall, we must provide against loss of water by evaporation. The common method of doing that, is to build a collector in the form of a funnel which directs the water into a narrow necked storage vessel. The Weather Bureau used a collector which is eight inches in diameter at the top. Mr. Kadel suggest, however, that for anyone building his own rain gauge, it would be a good idea to make their rain gauge exactly five and thirty-six hundredths inches in diameter at the top. With a five and thirty-six hundredth inch diameter, each fluid dram of water caught in the collector will correspond to one-one-hundredth inch of rainfall. That is very convenient size, because then you can measure the rainfall collected by simply pouring the water into a measuring glass such as you can buy at most any drug store.

If you make a rain gauge 5.36 inches in diameter, and use a funnel, Mr. Kadel points out that the funnel should be nearly or quite three inches deep to prevent outsplashing. The slope of the sides of the funnel should be not less than 45 degrees.

If you want further information on rain gauges and rainfall measurement, you can get it from the circular the Weather Bureau has prepared as "instructions for cooperative observers." That is Weather Bureau Circular No. 843. You can get it for ten cents from the Superintendent of Public Documents, at the Government Printing Office, Washington, D. C.

As you understand, rainfall is often a very local proposition. The United States Weather Bureau with all its five thousand rainfall stations, may never catch or measure the rain in many of the more thinly settled localities of this country. For farmers or engineers or others the rainfall in any particular locality at some distance from the regular Weather Bureau station may be of great practical importance. For example, an engineer called upon to build a sewer big enough to take care of the water without spending too much to build it unnecessarily big, would be greatly helped by knowledge of the exact rainfall in that immediate locality.

However, any of you people who decide to build a rain gauge, Mr. Kadel says, should keep in mind that the rain gauge must be exposed reasonably free to the sky. Small objects twice their own height away from the gauge are not objectionable. Place the rain gauge on the ground, preferably where surrounding shrubbery or low fences break the force of the wind. Do NOT place the rain gauge on a roof, unless, as Mr. Kadel says, you are so unfortunate, as is the Weather Bureau itself, to be compelled in order to render service to a great mass of people to maintain offices in the heart of cities. Under such conditions, the Weather Bureau makes the best of a bad situation, by placing the rain gauge so as to take advantage of the shielding effects of surrounding buildings. The Weather Bureau imitates as far as practical the ideal ground exposure.

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ANNOUNCEMENT: That idea of private individuals measuring rainfall seems to have interesting possibilities. We are asking old Ob. Server to thank Mr. Kadel for his suggestions, the next time he chats with that particular weather man. We will have another of these chats from the U. S. Weather Bureau this time two weeks from today.

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UNITED STATES DEPARTMENT OF AGRICULTURE

Radio Service

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U. S. Department

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CHATS WITH THE WEATHER MAN. Friday, Sept. 5,1930.

ANNOUNCEMENT: This is our time to chat with the weather man. Our old friend, Ob. Server, is here. He has evidently been to the United States Weather Bureau again. He seems to be all filled up with weather lore.-- What is it this time, Mr. Ob. Server? ------ What's on your mind? -------

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I've just found out that, as a rule, our long-distance, cross-the-oceans aviators spend considerable time at the library of the United States Weather Bureau. They study over the daily weather maps prepared in this and other countries they expect to fly over. For instance, flyers headed East across the North Atlantic like to get hold of the maps prepared in Germany and Denmark. Those and other from all the civilized countries of the world are there in our Weather Bureau library.

And the librarian tells me he is now looking for one of those ancient brick tablets of Babylon, known to contain weather proverbs of some three of four thousand years ago written in those queer cuneiform characters baked in the clay.

From the bricks of Babylon to the latest airplane flight; that gives you some idea of the range of weather information in the field of the U.S. Weather Bureau Library. In fact, that library is the world's greatest collection of modern weather science books, periodicals, and daily weather records. On weather, it outranks the Library of Congress and other great libraries of the world.

One of the problems of the librarian is to find space for the big big volumes of bound copies of the daily weather maps published in all civilized countries and which must be ready for use at any time.

You see, while some of us can just take the weather as she comes, but for those with business affected by the weather, the Weather Bureau library is a veritable treasure-trove.

It was used extensively during the World War for looking up climatic information about many parts of Europe in order to properly plan military operations, make proper provision in the way of clothing for soldiers, and the like.

It is used from day to day by those going abroad, and by merchants shipping goods to foreign countries. Merchants want to know whether shipments susceptible to certain types of climatic damage will encounter that kind of weather before they reach their destination.---- But come into the library with me. I want you to meet Mr. Talman. Mr. C. F. Talman is the

librarian of the U.S. Weather Bureau. He has charge of this strongest meteorological collection in the world. Incidentally, the two hundred small branch libraries located at the two hundred Weather Bureau Stations scattered throughout the country are also under his direction. And in his spare time, he is compiling an encyclopedic weather dictionary, of more than fifteen thousand weather terms, including slang, dialect, and scientific names for weather phenomena. He calls that dictionary his life hobby and says he collects weather terms as some other people collect postage stamps.

He figures that it may be some years before that unique dictionary is finished, but in the meantime each of the definitions collected is filed on a card and the collection is in daily use as a ready reference to strange weather terms which crop up in the work of the weather scientists.

Of course, one of the chief uses of the Weather Bureau library is for purely scientific purposes. The very heart of the collection is the part of the library devoted to the science of meteorology proper. It is not only used by the scientists of the U.S. Weather Bureau itself and other scientists who come to the Bureau for information, but it lends scientific books to proper accredited scientific people all over the country.

About one-third of the whole collection of books in the Weather Bureau library are bound volumes of scientific periodicals including publications in English, French, German, Italian, Dutch, Russian, Magyar, Japanese and other tongues.

Another department of the library has some ten thousand books giving descriptions and statistics of climate in all parts of the world. For instance, the Weather Bureau of India, where rainfall is often a matter of life and death to the people, issues each year a bound volume of rainfall data that is as big as an unabridged dictionary and weighs nearly twelve pounds. One of his haunting nightmares, Mr. Talman says, is what that file of volumes will be like in the year 5000. Germany, also has a great deal of weather, and leaves none of it unrecorded. The British are lavish publishers of weather statistics. The Russian weather experts are now trying to make up for lost time, with the publication of weather statistics for their vast territory.

Weather as a science, however, is comparatively young. As an organized science it extends only to about the middle of the nineteenth century. But when you realize that for years there have been more than thirty thousand observers in different parts of the world making observations two or three times a day, the volume of statistics already accumulated is tremendous.

But the collections of books on the weather at the U.S. Weather Bureau goes back far beyond the time of telegraphic weather reports and systematic measurement. It goes back beyond that first attempt at the collection of weather data through the cooperation of several observers in Italy in 1654.

Mr. Talman showed me a treatise on the weather published by old Albertus Magnus in 1494. That was just a paraphrase of the first scientific treatise on the weather written by the Greek philosopher, Aristotle more than three hundred years before the Christian era.

He also showed me a weather journal of the Rev. Wm. Merle in which were recorded the weather conditions in his locality in England day by day from 1337 to 1344. The first weather records kept in America as far as is known were also kept by a minister, the Rev. Johan Campanius. He kept a weather record day by day in the little Swedish colony of New Sweden near the present site of Wilmington, Delaware, for the years 1644 and 1645.

At that time, meteorological instruments were in their earliest infancy. There were no instruments used and no accurate measurements recorded They were just everyday observations of the general condition of the weather at that place. Old books such as those journals may throw some light on whether or not there have been any changes in our climate, but for the most part they are merely of antiquarian interest.

Mr. Talman says, however, that some of the meteorological libraries abroad surpass our U.S. Weather Bureau library in the matter of antiquities, but very few of them. As far as modern works on the weather are concerned, the library of the U.S. Weather Bureau, with its nearly fifty thousand volumes, is without doubt the largest and strongest meteorological collection in the world. Whether it is old or new, if it concerns the weather in any of its many and varied ramifications from prehistoric weather legends to the latest effort at long range forecasting it has a place in our great reservoir of weather information at Washington.

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ANNOUNCEMENT: Our old friend, Ob. Server seems to have enjoyed his visit to the greatest weather library in the world. It is certainly good to know where to find the facts. --- This time two weeks from today, with the cooperation of the United States Department of Agriculture, Station ----- will present another of these chats with the weather man.

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CHATS WITH THE WEATHER MAN. RELEASE Friday, September 19, 1930.

ANNOUNCEMENT: If there ever was a year when the weather was more cussed and discussed, we don't recall when it was. Our old friend, Ob. Server has done his part. But he gets his weather talk direct from headquarters of the United States Weather Bureau---and those experts generally know their weather. Here he is now. Well, Mr. Ob. Server, tell us about your latest chat with the weather man------

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Friends, between hurricanes and droughts, we seem to have had some weather this summer. Every time we've picked up a newspaper, more weather has been breaking into big print. One day it is a scientific discussion of the possibilities of long range weather forecasting. Another it is the superb flight of weather-wise French aviators west across the Big Pond. Still another, it is unusually mild weather in the Arctic which reveals the bitter fate of the long-lost Andree and his polar balloon party.

What would you say to this? That the discovery of Andree, due to less snow and ice in the Arctic this summer, may be linked with conditions in the tropic seas four years ago when a series of bad West Indian hurricanes devastated Miami, Havana, and Nassau in a single season. The idea seems absurd; until you find out that during that big hurricane year the waters of the Atlantic equatorial currents, which feed the Gulf Stream, were a little warmer than usual and continued so during the following two years. Those waters sweep north through the Atlantic carrying warmth with them. That big current spreads out and slows up. Its temperature affects the pressure and cyclonic activity over northern reaches of the Atlantic, where that ocean merges with Arctic waters. True, meteorologists have shown that the extra warmth of tropical waters should be almost entirely lost within a year, or about the time it would take them to flow from equatorial to Arctic regions. But this extra warmth must add to the general store of warmth in the Arctic.

Of course, at present this is just a plausible suggestion. While we know a good deal about weather, there are a lot of things yet to be learned about the atmospheric engine which makes the weather. We know, for example, the processes that cause rain, but we don't know why they should cease for a long time in certain areas and result in a drought. Maybe conditions out in the ocean play a big part. Mr. F. G. Tingley, chief of the marine division of the United States Weather Bureau, seems to think so.

And, by the way, Mr. Tingley says that when all the records are in, we'll probably find that there was just about a normal amount of rainfall this year, taking the earth as a whole. We didn't get enough, but France and Belgium and western Europe generally had too much rain. In the Argentine, they had to delay corn shipments to Europe until they could dry the corn. Even our own Western States had more rain than usual.

Of course, the seas being his province, you might expect him to take a world-wide view of things. And his division being engaged in studying winds and water temperatures at sea, grouping to find just what influence the ocean does have on our weather, it is not strange he sees weather from the ocean viewpoint.

By measuring the run-off compared with the amount of rain that falls, we know that about one-third our rainfall finds its way back to the sea. So one-third must come from the sea. As Mr. Tingley says, if we didn't get moisture from the ocean, if that third of our water supply was cut off, we would be in a bad way.

But there is more in sea weather than mere water. The ocean covers two-thirds of the surface of this old globe of ours. The upper layers of those vast stretches of water store up a lot of heat. Not only that, but there is a mixture of warm and cold water going on by means of big currents which sweep from warm regions to cold and from cold to warm. The biggest and best known of the warm currents are the Gulf Stream and the Japanese Current. The Labrador current and the Humboldt Current, along the west coast of South America, are the chief cold currents. That interchange of warm and cold water helps to even up things between the warm and cold regions.

We all learned that in our geography at school. But Mr. Tingley tells me that there is a slight difference between the temperature of the ocean waters from time to time. There are changes from year to year. The waters at the same point in the Gulf Stream, for instance, get warmer or cooler than usual some years. That may be due to a difference in the amount of floating ice from the south polar regions months before; or it may be due to actual differences in the heat received from the tropical sun. We just don't know yet.

If these changes only affected the sea, most of us might not have to feel concerned about them. But the water affects the temperature of the air over it. The temperature may modify pressure and thereby change the direction and force of the winds over the sea. That in turn may influence the distribution of pressure, temperature and precipitation over the land.

Some claim from knowledge of the temperature of sea water they may be able to forecast certain land weather far in advance of its actual happening.

Anyway, this question of sea temperatures is considered so important that, Mr. Tingley tells me, his division plans a more intensive study of the thousands of measurements already on hand in hopes of finding further clues to the ways of weather on land, and sea.

These records include a large number of temperature and wind measurements made by ships plying the waters of the Caribbean Sea and crossing the Gulf Stream. Most of those measurements of sea temperature are made by simply throwing a canvas bucket over the side of the ship and dipping up a bucket of water and sticking a thermometer in it. The velocity of the wind is measured at the same time, as the depth of mixing of the warm surface water with the cooler water beneath it depends on the wind. The velocity of the wind is taken as an index to the depth of the mixing.

In order to get a better check on the temperature records taken that way, the American Meteorological Society in cooperation with the Weather Bureau recently installed an automatic recording thermometer on a Key-West-to-Havana car ferry boat which crosses the Gulf Stream. The bulb of the thermometer is built to fit in the pipe where the ship takes in water for its condensers. The temperatures are recorded continuously by an automatic pen which traces a jagged line corresponding to the changes in the temperature of the water. When the ship strikes the warmer water of the Gulf Stream the line goes up sharply. When the ship passes out of the Gulf Stream the line on the paper drops down again. One little strip of paper shows the exact record of changes in temperature during one week's trips. Similar instruments have been installed on other ships crossing the Gulf Stream at different points in its course.

More recording devices together with the usual bucket observations will give our weather scientists much information about the minute vagaries of temperature which may mean much to those of us far from them.

It doesn't seem impossible that some of the secrets behind our great inland drought may be literally dipped up from the sea in a canvas bucket.

Anyway, the scientists of the marine division of the United States Weather Bureau are trolling for facts about our complex land-and-sea weather problems.

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ANNOUNCEMENT: We hope you enjoyed your refreshing dip in the sea, They say it is always fair weather when good fellows get together? It certainly seems to always be interesting weather, when the weather experts get together. Old Ob. Server will bring us another chat from the weather man two weeks from today.

It should seem impossible that some of the [illegible] thought may be literally dispersed into the [illegible] in a century hereof.

Anyway, the scientists of the Meteorological Service [illegible] Weather Bureau are trying for those future [illegible] weather problems.

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[illegible]: [illegible] you [illegible] [illegible] [illegible] [illegible] [illegible] it is always fair weather when [illegible] [illegible] [illegible] [illegible] [illegible]

UNITED STATES DEPARTMENT OF AGRICULTURE

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CHATS WITH THE WEATHER MAN.

Friday, Oct. 3, 1930.

Department of Agriculture

ANNOUNCEMENT: Every other Friday, our old friend Ob. Server, chats with us about his chats with the weather experts at the United States Weather Bureau. He was at the Bureau when the recent drought was declared broken. After such a long dry spell as we had this summer, that was what you might call a "historic moment." ----- Tell us about it, Mr. Observer.

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"The drought is definitely 'busted'!"

Mr. C. L. Mitchell, principal weather forecaster at the United States Weather Bureau, said just that. He said it confidently, and with his best 'I-told-you-so' smile.

There before him was a map of the United States with the latest rainfall reports from stations over the country charted on it. One glance at that chart showed heavy, sod-soaking rains of the past twenty-four hours well scattered through the dry regions, just as Mr. Mitchell had predicted there would be several days before.

But one of the other Weather Bureau men standing by shook his head. He had just come from a trip into the nearby country, still dry, parched, and waiting for water. He protested that the drought was still here.

Then Mr. Mitchell opened the bigger forecast map lined and circled with its "highs" and "lows". To a weather-wise man, it was a refreshing sight. Instead of the puzzling stagnation of air which had confronted the forecaster for weeks, there was a picture of more normal weather conditions comparatively easy for the trained meterologist to interpret. Mr. Mitchell did not hesitate to point out the probability of more refreshing rains within the next twenty-four hours in many of the remaining dry sections. And, I noticed, we got them.

As he put it, rainfall acts as a sort of "revolving fund" for farm relief. Once the land gets well saturated with water, the revolving fund is established. That rain makes for more rain. The sun comes out. There is a lot of evaporation. A large percentage of that rainfall gets back into the air. The warm air filled with invisible moisture rises. Along comes a body of cool air. That cool air comes as a wedge seeking the lower levels because it is heavy air. The warm air and the cool air meet. The warm air rises over the wedge of cool air. Cooling the moisture in the warm air becomes visible as clouds. The moisture particlesin the clouds become bigger and bigger and fall again as rain.

That in a very rough general way is what happens when it rains. As Mr.

Mitchell points out, there are three things we have to have to get rain. We have to have warm air movement. We have to have cool air movement. And we have to have moisture.

Warm, moist air is not enough. Cool, moist air is not enough. We must have warm air, cool air, and moist air. The Caribbean Sea and Gulf of Mexico are a great reservoir of moisture for our country. Warm air filled with moisture sweeps north into the United States. But unless that warm air meets with cool air it dries out and produces no rain. Ordinarily huge masses of cool air from the northern Pacific and Canadian northwest move down in great wedges, which force the warm moist air to slide up over them where the moisture cools and condenses into clouds and then falls as rain.

This past July and August, however, there was a great lack of masses of cool air from the North. As the drought became more and more widespread, the forecasters had to depend more and more on the big general movements of air over the continent in making their predictions.

But when the reports of the barometric pressure, and the speed and direction of the wind, and the temperature taken at the hundreds of Weather Bureau stations were plotted on the map of North America and when the stations of the same pressure in the different regions were connected up with lines, as you have seen them on a weather map, the usual signs of rain were lacking. The big areas of high pressure, associated with cool winds from the North, were either lacking or were blocked off, from movement down to us by other pressure conditions. There was a sort of traffic jam which kept our rain-making supply of cool air from getting through.

And right here, let me say, that there is nothing that smacks of the work of the goose-bone prophets in the predictions made by forecasters of the United States Weather Bureau. Of course, the correct interpretation of which way the traffic of great "high pressure" and "low pressure" air masses will move takes sound judgement and a vast deal of experience and study of what has happened under similar conditions in the past. The forecaster is able to judge what will be by knowing what is. He is able to say what's coming, largely because radio and telegraph messages from his observers in the field travel faster than the wind. At the same time each day, observers at stations scattered throughout the United States, and in Alaska, Canada, Greenland, and Iceland, report the temperature, and pressure, and wind movement at their stations. The Canadian government supplies the reports from northern Canada by radio, and the Danish government those from Greenland and Iceland. Our observers in Alaska get up at two o'clock in the morning to make their instrument readings; so that our forecaster's daily picture of weather conditions will not only be practically complete but perfectly in focus in point of time.

A few years ago, Mr. Mitchell tells me, it would have been impossible for anyone to have accurately forecast the break in the drought as far ahead as he did. Until recently, our weather forecaster's map ended a little beyond our northern border. Now, however, through extension of our own service in Alaska, and through the cooperation of the Canadian and Danish governments, we get a broad general picture of the weather up to the Arctic. The Canadian government recently began supplying us additional reports from some of the re-

maining blind spots on the weather map. The first reports from one of those stations came in just in time to enable Mr. Mitchell to trace the movement of cool air which helped break the drought. These northern stations have given us from one to two days bigger jump on wind movement from the North.

Not only that, but our forecasters have added a third dimension to their range of observation. Knowledge of wind movement aloft is highly important in interpreting conditions at the surface. Pilot balloon observations of air movements at different levels are now being taken at a large number of points scattered along our airways. In addition, a complete record of temperature, pressure, and air movement from the surface up to several thousand feet is now being made every day by means of airplane flights at Pensacola, Florida, Norfolk, Virginia, and Washington, D. C. The maps of upper-air conditions, as well as our ever widening surface weather map, are considered by the forecaster in deciding what the complexities of weather hold in prospect for us. All his work is based on conditions as recorded by accurate weather measuring instruments. He does not predict "sight unseen."

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ANNOUNCEMENT: Our old Ob.Server gives us another of these chats with one of the weather men of the United States Weather Bureau two weeks from today. Station_____presents this program in cooperation with the United States Department of Agriculture.

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CHATS WITH THE WEATHER MAN. RELEASE Friday, October 17, 1930.

ANNOUNCEMENT: Here is our friend Ob. Server again. He is ready to tell us about his most recent chat with the weather man. Every two weeks, you know, he visits with the scientists of the United States Weather Bureau. Let's hear what he has to say this time about that greatest of all conversational topics --- the weather.

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About this time of the year, we usually get a very practical interest in the weather. The weather makes itself felt. It impresses us with its importance now, even if its antics this summer didn't convince us.

Even if there is no "cold wave" just beyond the horizon, we know it won't be long now.

We are glad to get warning in time to protect our water pipes in the house and in the automobile radiator. We don't like cold waves to slip up on us too suddenly; to steal up on us in the night. We take the warnings as a matter of course. We use them. But did you ever think of the many practical ways in which we are helped by the science of meteorology?

Dr. W. J. Humphreys, meteorological physicist of the United States Weather Bureau, called my attention to a few of them. He says that applied meteorology plays an important part in practically every occupation, from a to z.

"A" is for aviation. Dr. Humphreys says an aviator may not, as a rule, need to have very much weather information. He may not need the information very far ahead. But what he needs, he needs, and he wants no may-be about it. For most purposes, in northern Ohio, for instance, it is quite enough for most folks to know there will be local showers this afternoon, But the aviator wants to know whether there will be a thunderstorm over the Cleveland airport at 3 o'clock sharp, the exact time he is due to arrive at that particular place. And aviation is just one field in which the weather scientists are constantly being called on for more specific, detailed weather information than we were accustomed to a few years back.

On the other hand, there is the demand for long range forecasts; that is, general forecasts far in advance. When we are starting into another season, we would like to know what sort of season it will be. At this time of the year, many folks dust off the old almanac and try to

read the answer from the wild guesses in its pages. Others pretend to predict by the length of fur on animals and the thickness of bark on trees as to what the coming winter will be like. Still others, cast the horoscope of the weather on the idea that weather repeats itself in regular cycles over a series of years. Such goose-bone prophesies are mostly "hooey".

However, Dr. Humphreys says there is one form of seasonal forecasting recognized by meteorologists as tolerably reliable and immensely useful. That is foretelling the amount of water that will be available during the summer and fall for power and irrigation in the western third of our country. That long-range forecast is based on snow surveys over various watersheds, or estimates from the record of the number and size of the winter snowstorms. Long range forecasts are practical in such cases, due to the simple fact that the snow lies on the ground a long time before it melts. It is largely a matter of figuring the amount of water in these snow reservoirs.

Another branch of meterological work that involves a greater or less long range feature is the warning of floods. It is possible to foretell with a high degree of accuracy what the down-stream stages of a river will be by knowing what the conditions are up stream. The amount of water in the soil, the extent, and depth, and location of the snow covering, the temperature, and amount of rainfall help tell what's coming. On short, swift streams the forecaster may be able to tell from the up-stream records what conditions down stream will be a few hours to a day later. On most rivers, forecasts can be made a few days to a week ahead. For such places as the lower Mississippi, forecasts based on up-stream conditions can be made two or three weeks ahead. Much property and many lives are saved each year as a result of such forecasts. As Dr. Humphreys says, that branch of meteorological science doesn't have to wait the coming of a spectacular, first page flood. For each of that kind there are hundreds of lesser ones that together call for continuous attention year in and year out --- yes, even this year of the Big Drought.

Then there is fire---forest fire. Meteorology is a big help there by predicting the coming of "fire weather" a day or two in advance, so the forest rangers can get their crews out, and sawmills shut down lest sparks from them may set fire to the tinder like duff which carpets the woods.

In the forest, along the rivers, and at sea, the help of weather information is highly prized, especially the warnings of high winds. If a storm promises to be a heavy one, many ships, especially the smaller ones, keep behind the break-water or in some other sheltered spot, until the storm has spent its force. In this way, vast property interests are protected and inmumerable lives saved, as well as greater comfort assured and reasonable insurance rates obtained.

A specialized but highly practical use of meteorology is the warning of heavy frosts in orchards at blossom time and harvest time. When the temperature of the air is considerably lower near the ground than it is 50 to 100 feet up, Dr. Humphreys says, protection from frost is not only possible, but in many cases economically practical.

When the skies are clear and the air is still, artificial heating may work all right. Other times, the orchardist would better save his fuel. Orchard heating is expensive and loss of crop disastrous, so the grower must have reliable information about when to heat. To heat when unnecessary is nearly as bad as not heating when it is necessary. In some of our orchards, notably on the West Coast, the frost warnings are highly reliable and of very great economic value.

Nor is that the only help the weather scientists give the fruit growers. Times to spray to prevent damages by scab is often a question of weather.

In fact, from seed time to harvest farmers need and make use of the services of applied meteorology, especially at harvest of any crop where sun-curing is needed and rain is damaging.

In fact, Dr. Humphreys points out that even the history of past weather is of immense importance to both farmers and more specialized plant experts. What has been the average monthly, seasonal, and yearly precipitation; what is the direction and the average strength of the winds, what is the average date of the last killing frost in the spring and the first one in the fall.

From such records of past weather, he says, we know the most promising places for testing foreign fruits, and trees, and plants, and what can and what can not be successfully grown at any given place. In that way, we know where to plant the tung tree, where to grow the Magadascar rubber bush, and where the finest dates would thrive.

So you see, the scientific study of the air has what Dr. Humphreys calls a "bread-and-butter" side to it. It is useful to us in every phase of life.

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ANNOUNCEMENT: I guess that disaproves that old wise-crack about everybody talking about the weather, and nobody doing anything about it. Two weeks from today old Ob.Server will be back to tell us about another of his chats with the weather man of the United States Weather Bureau.

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CHATS WITH THE WEATHER MAN. Friday, October 31, 1930.

ANNOUNCEMENT: This is the time for our chat with the weather man. But don't start to shiver yet. Our old friend, Ob. Server, tells us there was nothing cold or chilling about his talk this week with one of the specialists of the United States Weather Bureau. The subject was a genial one, dealing with tropic isles and pleasant breezes ---- But you tell them, Mr. Ob. Server ----------

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Before I take you down to the West Indies, I want you to meet Dr. Fassig. Dr. Oliver L. Fassig, is the new chief of the climatological division of the United States Weather Bureau. For the past fifteen years, he has been the big weather man of the West Indies, with headquarters at San Juan, Porto Rico.

His territory, you might say, extended three thousand miles East and West; and two thousand miles, North and South. It included the entire West Indies. Just a few months ago, he completed ten years of work as the representative of the U. S. Weather Bureau in organizing a rainfall reporting service in which six hundred stations of forty nationalities now cooperate. ----- but more about that later. -------

From what Dr. Fassig says, the tropics are not so hot; literally speaking.

He showed me, that it is really cooler in the West Indies in the summer time than it is in Washington, D. C. I say he "showed" me; because he had the temperature and wind day by day at San Juan and Washington charted, so you could see at a glance the exact picture of the two climates side by side.

There are more hot days in summer in Washington than in San Juan. There are also more cold days. The swing from hot to cold is bigger. In the tropics, the temperature is more even. There are not so many hot days, but more steady warm days.

That steady warmth, however, is relieved by the wind changes. The wind movement is greater in the tropics in the summer time than in middle-latitude places like Washington. The wind at Washington averages about

five miles an hour, in summer, while in Porto Rico, and other West Indian islands, the average is twelve to fourteen miles an hour. The humidity, Dr. Fassig admits, is greater in the tropic islands, but the wind also relieves a person of the inconvenience which he might otherwise feel on that score.

Another thing about the weather in the tropics, Dr. Fassig set me straight on, is the rainfall. I always thought there was a rainy season; but he says even the rainy season is not so rainy as many of us seem to think. There are very few umbrellas on the islands. When a shower comes up, the folks just step into a door-way or under a tree, and wait a few minutes, when it is all over and the sun is out again.

In Porto Rico, while they don't have any rainy season, they do have a wet and dry side to the island. One town on the dry side of the mountains has 35 inches of rainfall a year, while another town on the mountains only fifteen miles away has 125 inches of rainfall a year.

Of course, rainfall is important in the West Indies. In this year of the Big Drought in many of our States, we don't have to be reminded that rainfall is important to agriculture. In relatively undeveloped agricultural country like many of the West Indian islands, it is even more important to know about the rainfall than it is here.

Growing of crops is largely a matter of rainfall and rainfall distribution. That's true of sugar cane, for instance, in the cultivation of which millions of American capital is invested in Cuba.

Temperature is not so important as rainfall in determining the agricultural possibilities of the tropics, because the temperatures never get low enough to damage most crops. But the very constancy of temperature conditions in the West Indies, Dr. Fassig says, makes them a favorite hunting ground for weather scientists; especially those studying long period swings in weather conditions. Where conditions are more nearly uniform, any variation from the normal is more readily detected.

Then, too, the West Indies is the region over which tropical hurricanes pass on the way to our coast.

Up until ten years ago, anybody wanting information as to rainfall and temperatures as an aid to the solution of the thousand-and-one practical and theoretical weather problems involving conditions in the West Indies could not get it, without an immense amount of labor involving years of correspondence.

In 1919, the United States Weather Bureau set Dr. Fassig at work knitting together a complete system of rainfall reports to give the day by day picture of the weather conditions throughout the entire wide area including the West Indies islands, and the coasts of northern South America and eastern Central America. Dr. Fassig visited every island and secured the cooperation of officials of each of the forty nations which own territory in that vast and varied region. In the first preliminary survey of the field, every country involved promptly expressed approval of the plan.

Starting with sixty rainfall stations with headquarters in Porto Rico, the system has been extended until there are now six hundred stations reporting the daily rainfall to San Juan. Cuba has 100 stations; Jamaica 30; Haiti 50; San Domingo 75; the Bahamas 15 to 20; every island of the Lesser Antilles has at least one station. Our own little islands of St. Thomas, St. John, and St. Croix, of course, have rainfall stations. The Barbadoes have 25; St. Lucia 15, Guadalupe 15, Dominica 15. Trinidad, and the northern coast of South America down to Britisn Guiana and Dutch Guiana and around to the Panama Canal Zone with 30 stations and others along the Central American coast.

The rainfall records reported by this great net-work of tropical stations, Dr. Fassig tells me, are gathered together and published each month at San Juan, Porto Rico. Now for the first time, the actual daily rainfall of the West Indies is available to commercial interests and weather scientists interested in knowing conditions on these many tropic isles and surrounding seas and lands

Shortly before coming to Washington to take up his new duties, Dr. Fassig, made an inspection trip from San Juan to Dutch Guiana, South America, by airplane in five days. A few years ago, when this work was started that same trip took five weeks.

Since then Porto Rico has become a cross-roads for mail and passenger planes plying between the United States and South America.

But the airplane weather service of the San Juan station of the United States Weather Bureau is another story. Dr. Fassig was showing me a chart of the changes in the depths of the famous trade winds, as they affect flyers. Dr. Fassig is a great man for charts ---- but more about that some other time.

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ANNOUNCEMENT: Old Ob. Server has just told you about the recently completed rainfall reporting system of the West Indies as outlined to him by Dr. Oliver L. Fassig, chief of the climatological division of the United States Weather Bureau. This Station _____ will present another of these chats with the Weather Man two weeks from today.

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CHATS WITH THE WEATHER MAN. Friday, November 14, 1930.

ANNOUNCEMENT: And now for another chat with the weather man. Our old Ob. Server, has been talking with the Chief of the climatological division of the United States Weather Bureau, about some of the recent work on winds in the West Indies. ----- Tell us about what has been discovered, Mr. Ob. Server?

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For nearly ten years now, the United States Weather Bureau has been exploring the heights and depths of the famous northeast trade wind.

Those are the remarkably steady winds which did so much to put America on the map, by boosting Columbus and other early Spanish explorers on their way to the New World. Now they are being used to aid air travelers on their way.

These trade winds in the tropics make our West Indies a delightful place to live throughout the year.

Dr. Oliver L. Fassig, chief of the climatological division of the United States Weather Bureau, says few people seem to realize how important winds are in making climate. They speak of temperature as being the whole thing. What really counts is the combination of temperature, and moisture, and wind movement.

Very high temperature with very dry air can be very healthful and comfortable, as is our own Southwest.

Where you have a high temperature with very moist air and only a slight wind movement, you have a disagreeable, unhealthy climate. But you can have a combination of high temperature, and high humidity, with decided wind movement, resulting in a pleasant, comfortable climate in spite of the heat and humidity. That is what you get in the West Indies, Our West Indies lie entirely within that belt of strong steady winds from the East which encircle the globe from eight to ten degrees to about twenty to twenty-five degrees North latitude. There is a similar belt about the same position South of the equator. Continental land masses break up those winds more or less, They are best developed over the oceans. Because they were strong and steady they were big helps to early trading vessels, and have been known for centuries as trade winds.

But the ships sail at the bottom of those big currents of air, What's upstairs in the trade winds? Above the trade winds, the winds

blow from the West. How high do the trade winds go? Where are they strongest? In these days, when airplanes travel through the trade winds instead of at the bottom of them as do ships, those are highly practical questions. The aviators want to know where they can find winds to best boost them on their way.

Weather scientists the world over also want to know more about the trade winds and the part they play in the general circulation of the atmosphere of the world.

For that reason, the United States Weather Bureau started to explore the trade winds by means of small rubber balloons released every day from the station at San Juan, Porto Rico. Dr. Fassig, who had charge of that work, says that as a result of these soundings of the heights of the trade winds, discoveries have been made which prove these winds are vastly different from the accepted ideas pictured in the text-books.

The well-known system of making the soundings by pilot balloons is comparatively simple. The balloons are filled with hydrogen gas until they attain a given free lift. When released, they rise at a uniform rate per minute, so long as there are no leaks in the balloons. The length of time a balloon is in the air gives its height at any moment. The position of these little balloons is noted at the end of each minute by means of a telescopic instrument for determining the angle of change from one minute to the next. By triangulation, the velocity and direction of the winds can be very accurately determined to great elevations.

The balloons may be lost in the clouds in a few moments, but ordinarily, there is so much bright weather in the tropics that our experts have been able to get records of the wind movement up to fifteen to twenty thousand feet as an average throughout the season.

In fact, Dr. Fassig showed me a chart he had made picturing the heights reached by some of the balloons above San Juan, together with the world's records. At favorable times, the balloons have been watched for over two hours before they were lost or disappeared in a cloud, at heights of fifty to sixty thousand feet, some ten to twelve miles up, and far beyond the highest ever reached in airplane or manned balloon.

From soundings made in this way, it has now been found, Dr. Fassig tells me, that the depth and direction of the trade-winds vary at different seasons of the year, and from day to day. The trade winds do not have that uniform flow and depth formerly thought. There are big changes from day to day, and even hour to hour.

Usually, Dr. Fassig found, the trade winds are shallowest in the month of May, when they average about three miles deep; and are deepest in the month of August when they are five miles deep. That is the average. The cross-section chart of the trade winds day by day prepared by Dr. Fassig shows some days that the great west wind movement from above the trades even dips down to the surface of the ground. But usually those winds from the West don't stay at the surface more than a few hours or at most a day.

The trade winds themselves may vary from a few hundred feet deep one day to six to eight miles deep the next.

These daily observations of the speed and direction of the winds at different heights are forwarded to all flying fields along the airplane routes of the West Indies, so the pilots can pick the best level to fly.

Of course, the air travel is largely in the lower levels of the trade wind observations. The force of the wind increases steadily from the surface up to about two thousand feet and then begins a steady decrease, but information about the variations from such average conditions is often highly important to flyers in the tropics.

At the surface, however, the strength and constancy of the proverbially inconstant winds insures pleasant weather in the West Indies throughout the year, and provides a potential source of power to drive wind-mills for pumping and other operations which is even yet not fully recognized, Dr. Fassig says.

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ANNOUNCEMENT: As the Psalmist would say; "Yea, he did fly upon the wings of the wind." Two weeks from today, old Ob Server will be back with another breezy chat with the weather man of the United States Weather Bureau.

UNITED STATES DEPARTMENT OF AGRICULTURE

Radio Service

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WITH UNCLE SAM'S NATURALISTS. RELEASE Friday, November 21, 1930

ANNOUNCEMENT: Our Wilds Man is wild. And he may well be. He has been to naturalists of the United States Department of Agriculture. They have told him about the effects of drought on quail and other birds. It is a serious situation. Our Wilds Man has a massage for us all. He says ---- but I will let him tell you what he says -------

****

Well, men, it looks like a hard winter for our game birds!

You have heard a lot about the drought and the need for drought relief. As you know, the corn crop is the shortest in nearly twenty-five years.

In some sections, the crop is so short that the usual supplies of standing and shocked corn left in the field won't be there to feed the birds this winter. The last shocks may be hauled from the fields at the very time when upland game birds will be most in need.

That's not all. There has been a partial to complete failure of many natural game foods locally over much of the country.

The naturalists of the United States Biological Survey tell me conditions this coming winter threaten to be the hardest on birds in many years. If we are to have good hunting next year, we will have to do something to help the birds through this winter, particularly the quail, grouse, partridges, pheasants, and other upland game birds.

Mr. Wallace B. Grange, of the Division of Food Habits Research, of the Biological Survey, says that well-fed wild game birds rarely if ever die of cold, even in the most severe weather of our northern winters. However, starved or half-starved wild game birds to die in big numbers during severe weather. To prevent those losses being much greater than for many, many years, the birds must have enough food, especially late in the winter.

That's why the Biological Survey has issued a call for all sportsmen, and hunters, and bird-lovers to do all they can to provide food where the supply is short.

You men and boys who live on farms and love to see these birds around or like to hunt them are here and now urged to help the game birds on your farms as much as you can.

In some cases, State game commissions, and game wardens, and sportsmen, and game protective organizations will be willing to cooperate with farmers in providing labor, and feed, and funds to meet the emergency in the late

winter period.

Thousands and thousands of dollars have been spent in stocking lands with upland game and in protecting our native birds. As Mr. Grange sees it, unless we provide feed this winter on such lands, there can't be many birds to hunt there next year.

"How about scattering shelled grain from airplanes?" I asked Mr. Grange." Wouldn't that be a good way to get feed to the birds?"

"No," he replied, "As a rule such stunt methods are wasteful. Grains spread that way sink fast in loose snow or are soon covered by drifts or fresh snow. The effect of such feeding doesn't last long.

"Birds starve, not so much on account of short rations for a few days, as because of short rations over considerable periods of time. Consistent regular feeding is far better than spectacular intermittent methods. And it is altogether wasteful and ineffective to scatter loose grain as bird feed on soft snow.

"How would you suggest feeding game birds then?" I asked.
And here are some of the suggestions Mr. Grange gave me.

He said that leaving standing, unhusked corn in the field is probably the best way to provide food for birds in most northern States.

But most of the time it is hard to get standing corn. The next best thing is shocked corn near thickets, or woods, or swamps. If the shocks are opened up to form a sort of tepee, the birds will use them for refuge as well as food. But unless the shocks are opened up or are near good cover, goshawks or other game-bird enemies may get the birds that resort there.

Hungarian partridges will often take feed far from any considerable cover, but quail like cover. It may be necessary to haul shocks nearer cover for some birds. It is generally a good idea to have the shocks within seventy yards of cover.

Where a lot of game birds feed on corn shocks, the outer ears are soon completely shelled and the birds can't reach food. Be careful to have enough corn exposed at all times. That means opening up shocks regularly.
And after snow storms or sleet, better check up on the situation. The ears may be coated over, so the birds can't get to them.

Mr. Grange suggests that farmers who still have fields of standing corn, which they intend to "hog-off" or turn cattle into, can feed near-by game birds easily by fencing off a small corner so that stock can't get to it. Sportsmen and hunters might be willing to provide labor and fencing materials.

Standing corn and corn in the shock are very satisfactory for quail, and pheasants, and Hungarian patridges, and prairie chickens, and sharp tailed grouse, as well as for miscellaneous song birds and for rabbits, squirrels, and deer.

Sometimes game birds become so heavily concentrated on some fields that they might destroy more grain than the farmer can afford to spare. Cases of that kind call for cooperation between farmers, game commissions, and sports-

men's clubs, and humane societies to compensate the farmers and to buy additional grain for the birds.

Quail and many other kinds of birds readily take to shelter feeding. That is, a lean-to or topee type of shelter can be rigged up out of branches, or cornstalks, or boards, or most anything to provide protection from falling and drifting snow. Wheat and other threshed grains can be scattered inside. Such natural retreats as wine-covered fences, berry patches, and the like are especially effective.

Of course, you can get best results by building the shelters in natural game coverts rather than trying to entice the game into barnyards or too far into the open.

And here is another thing to remember: Don't feed game birds with chickens or turkeys or other domestic poultry. You know, our naturalists are finding more and more that many diseases and parasites can easily be transmitted from barnyard fowl to wild birds and the other way around.

Mr. Grange mentioned other ways of getting feed to game birds. One of these is to open strawstacks, which often have considerable waste grain and weed seed in them, and another is to spread manure on the fields regularly every day and every now and then throw out some threshed wheat or other grain on it. Occasionally sheaves of wheat, buckwheat, oats, and other grains stored for late threshing can be obtained and set upright in the snow or hung by wire or cord from limbs of trees where the birds can reach them by jumping. Ear corn set on stakes, or fences, or branches is adapted to feed practically any game or other grain-eating bird.

The big point I want to impress on you, however, is to look around your locality or about your favorite hunting grounds and see what you can do to help see the birds safely through the winter.

It may be a matter for cooperation with some organization or groups of organizations. Canvass the situation now. Mr. Grange says the situation is serious, and he has written a leaflet describing the methods of feeding game birds that I have mentioned. Its title is "Winter Feeding of Upland Game Birds." Copies may be obtained by writing to the Bureau of Biological Survey, Washington, D.C., and asking for mimeographed leaflet Bi- 1099.

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ANNOUNCEMENT: You have just had called to your attention the threat of starvation and freezing which hangs over our game birds in many sections of the country. The rest is up to you. Let me repeat the title and number of the leaflet mentioned by our Wilds Man -- "Winter Feeding of Upland Game Birds" -- Leaflet B - i - 10 - 99. Two weeks from today, our Wilds Man will bring us some other call of the wild as interpreted by Uncle Sam's Naturalists in the United States Department of Agriculture.

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CHATS WITH THE WEATHER MAN. Friday, November 28, 1930.

ANNOUNCEMENT: Now let's hear from our old friend, Ob. Server. He has been chatting again with some of those meteorologists of the United States Weather Bureau. The snow has begun to fly, and he seems to have gotten an earfull. Well, Mr. Ob. Server tell us about that drifted whiteness covering the fair face of Nature --- and a number of other things --------

****

Hats off, men!

If you don't have your hat on around the radio, let's salute anyway.

Let's salute those forest rangers and other hardy cooperative observers who will soon dare the perils of the mountains, and head out on snow-shoes to check up on the snowfall.

It takes nerve and stamina to go into the high mountains of our West in the dead of winter as some of those men will go. Storms and snow-hidden crevasses, and icy-edged cliffs are a few of the dangers they will face.

Yet, Mr. Montrose W. Hayes, chief of the river and flood division of the United States Weather Bureau, tells me, that every year they do it. Beginning about the first of January, the Weather Bureau sends them out equipped with snow-measuring apparatus. They go over the snow fields and check up on the extent of the fields, and the depth and condition of the snowfall, in the mountains where the snow will hang on well into or through the greater part of next summer.

There is good reason for all the risks they run.

You know, snow is just water in another form.

Irrigation projects in the West and the water supplies of many western cities and towns, Mr. Hayes says, are in a large measure dependent on the amount of snowfall. To know how much water will be available for use in mining operations, for power dams, and irrigation reservoirs, it is necessary to know considerable about the amount and condition of the snowfall. The very life of great

ANNOUNCEMENT: Now let's

stretches of our western country is fed by the melting snows from the Rocky Mountains and Coast Ranges.

The hardy snow-shoe scouts, experienced in mountain travel, measure the depth of the snow by means of stakes previously fastened to trees or set in the ground.

To determine the condition of the snow, they carry snow samplers and light spring balances. As Mr. Hayes describes it, the snow sampler is usually a long tube about two and a half inches in diameter with a scale marked on the outside of it. The observer pushes this tube down into the bed of snow, the depth it goes into the snow being measured by means of the scale on the outside the tube. Then he pulls the tube out full of snow up to the depth it was pushed in.

The object is to find how much water there is in the snow. The more icy the consistency of the snow, the greater the amount of water in it and the longer the snow will last. The tube is weighed on the balance the observer carries with him. The tube is a standardized instrument. Knowing the weight of the snow, it is a simple matter to determine the number of inches of water to which that weight corresponds.

If the snowfall has been light and not wind-packed or sunpacked, it goes off in a hurry. That means a shortage of water shortly after the summer starts. On the other hand, if the snowfall is heavy and well packed by the wind, and then softened by the sun, and frozen again, it forms an icy mass which will last a greater part of the summer.

The reports of the observers are collected in the various district offices of the Weather Bureau. There they are charted and forecasts of the summer supply of water are made for the various streams heading in the mountains.

This snow survey, Mr. Hayes tells me, is difficult and hazardous work, but it is very necessary, and is considered one of the most valuable undertakings of the United States Weather Bureau.

The men who make the survey usually work on a cooperative basis. Most of them are forest rangers.

The survey covers only the Rocky Mountain and Coast Range, as snowfall in our eastern mountains is not so big nor is it the tremendously important factor in the water supply it is in the West.

However, in the Eastern half of the country, the ice in our rivers and harbors is often of considerable importance. Mr. Hayes tells me the Weather Bureau makes measurements of the thickness of the ice and keeps a close check on the movement of ice in rivers.

stretches of our western country is [illegible] from the Rocky Mountains and to the Pacific.

The survey crews, experienced in mountain travel, [illegible] the depth of the snow by means of staffs previously [illegible] trees or set in the ground.

To determine the stability of the snow, they [illegible] and light spring balances. In the [illegible] sampler is usually a long tube about two [illegible] with a scale marked on the outside of [illegible] tube down into the pack of snow, the [illegible] being measured by means of the scale on the [illegible] can be pulls the tube out full of [illegible] is weighed in.

[illegible] feet to the first box [illegible] for the operator [illegible] and the [illegible] the observer [illegible] the observer [illegible] If the [illegible] not wind-packed or [illegible] snow is very [illegible] the observer starts. By [illegible] found, if [illegible] usually [illegible] the [illegible] snow again. [illegible] the surface.

The reports of the observers [illegible] in the [illegible] of the Weather Bureau. [illegible] date of the summer supply of water [illegible] in the [illegible].

[illegible] It [illegible] no, is difficult [illegible] it [illegible] Storage [illegible].

[illegible] make the winter [illegible] [illegible] are forced [illegible].

The survey covers only the Rocky Mountain and Coast Ranges, [illegible] in our eastern mountains is not [illegible] in the summer and very important [illegible] the water supply it is [illegible].

[illegible] Engineers Unit of the country, [illegible] [illegible] stations [illegible] the [illegible] of the [illegible] [illegible] the measurement of [illegible].

That is not a matter of settling local bets as to how thick the ice was this year compared to last. Its chief importance is in determining what may be expected when the spring break-up occurs.

After a severe winter, early spring floods are especially disastrous at times on account of the jamming of ice which dams the streams.

Mr. Hayes points out that, the Mississippi and Ohio, might be clear of ice and shipping in progress, but immense quantities of ice be jammed up stream. The Weather Bureau watches such ice gorges closely. Sun and rain lossen the gorge and great flows of ice are likely to sweep down stream and cause big damage to barges, packets, and all other forms of river craft.

At the Weather Bureau sub-stations, the river gage reader keeps a record of the ice formed, and its condition, and telegraphs or telephones that information to the district office.

The Weather Bureau station keeps men on duty all night, and special watchmen are held on duty continuously just to watch the ice gorges when weather conditions indicate a break is imminent.

Pittsburgh is the city most often interested in ice conditions, for ice often does considerable damage at Pittsburgh. However, during the winter of 1917-18, Mr. Hayes says, there was more ice in the Mississippi river than during any other winter on record. The river was full of ice from Memphis to its source, and river packets and barges were sunk by ice at Memphis. Some of the ice went south of Vicksburg, Mississippi.

But we are getting a little ahead of our weather. We started out to talk about the snowfall survey, which is the basis for the practical long-range forecast of summer water supplies in the West. I don't know how you feel about it, but my hat is off to the men who make the snowfall measurements in the mountains!

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ANNOUNCEMENT: That's another of those services of the United States Weather Bureau. Old.Ob. Server will be back two weeks from today to give us the results of another of his chats with the weather man. These chats are presented by Station_____ in cooperation with the United States Department of Agriculture.

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WITH UNCLE SAM'S NATURALISTS.

★ DEC 4 1930 ★
U. S. Department of Agriculture

Release Friday, Dec. 5, 1930.

NOT FOR PUBLICATION

Speaking Time: 10 minutes

ANNOUNCEMENT: Our Wilds Man has been telling us about the creatures of the wild, as he has found out about them from the Uncle Sam's Naturalists of the United States Department of Agriculture. Today, instead of telling us about animals and trees; he is going to tell us about the men who protect them both ------Go ahead, Mr. Wilds Man, tell us about the forest rangers-----

*****

I don't know why I should pick this time of the year to talk about forest rangers.

Unless it is, that one time is as good as another. The forest ranger has a job which runs 365 days to the year. And they do say, at times, it runs 24 hours a day.

He has plenty to do; not only himself, but in looking after other folks.

But anybody who starts talking about forest rangers is taking in a lot of territory. We've got national forests scattered through 29 different States and in Alaska and in Porto Rico. They tell me, at the United States Forest Service that there are 735 of these forest rangers, on 149 national forests.

I guess they are all he-men. In most cases, forest ranging is a he-man's job. I don't know about my friend, Bill. I won't mention his other name. He is a district ranger on an Oregon west side national forest.

If you could ride out there with him, as I did, you'd never guess there were any 734 other forest rangers in the service. Out there on the rough trail, with the high peaks towering over us, and a deep canyon yawning almost at the horses hoofs, it seemed to me that Bill was as near alone with Nature, as a man ever gets in this world. Bill knows his Nature too, from the birds which soar among the peaks to the litter which carpets the ground under the trees, which cover most of the 280,000 acres of land in his ranger district. There are considerably more than five billion board feet of timber Bill has to protect, he tells me.

As we were climbing up one of those trails, Bill noticed a bad place in the path, and dropped a remark about fixing it up, and I began to realize that a forest ranger does something besides range around through the woods.

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Although there are no towns, or ranches, or settlements in all Bill's district, the works of man are not altogether shut out of his Eden. There are 38 miles of main roads, and 688 miles of trails and ways, and 140 miles of telephone lines in that district of his. What's more he is responsible for keeping up all those telephone lines, and trails, and ways, and roads. Fact is, his 280,000 acres are not well enough protected yet. He has before him quite a job of building new telephone lines, new cabins, and bridges, and new trails.

Going along there together, with Bill telling me all this, I began to think of the forest ranger's job as chiefly that of a road engineer, of the type of those "pioneer souls" who blaze the paths where "highways never ran."

That is, I did until we came to some of those mountain meadows or open grassy ridges. Then Bill turned his attention to the condition of the forage plants as they had been left when the sheep were taken off this summer range. Then I had to revise my idea of a forest ranger. You know the Government grants permits to ranchers to use parts of the national forests for grazing their stock, their cattle and sheep. Bill's district, provides summer range for 5500 head of sheep. Bill has to check up on the sheep entering the forest, and the condition of the range, so as to prevent over-grazing of the land. In fact, he is a sort of boss rancher, as well as a road engineer.

He is a game warden, too, so the wild life of the forest comes under his protecting eye as well as the herds of cattle. And the animals include, a lot of us two-legged animals such as campers, and hikers, and fisherman, and berry pickers, and hunters, and trappers, and stockmen, and loggers and water power men. Of course, there are not enough of them to make the forest fastnesses look like Main Street on a busy afternoon.

The campers and hikers, Bill tells me, used to cause him more trouble than they do now. But nowdays they are getting tamed to the ways of the wild. There are more of them, but most of them are more careful to see that the last spark is put out before they leave a camp site. They don't throw still smouldering cigarette butts in the forest litter, as much as they once did.

That is a big help to Bill. As you know, protection of his forest from fire is one of any forest ranger's biggest jobs. Eternal vigilance is the price of safety to the timber and the animals and even the human beings who use the woods for recreation. Not only are thoughtless, careless campers a menace which often blasts fine stands of timber over wide stretches of land, but many fires in Bill's district are set by lightning.

His look-out men on the high peaks must see the tell-tale smoke of fire from any cause and report it at once. That is one of the main meanings of that 140 miles of telephone lines, and those more than seven hundred miles of roads and trails. The fires must not only be reported promptly, but the crews of fire-fighters must be rushed to the scene of action as quickly as possible, to prevent the spread of the damage.

In his little district --- I call it little, because in all its vastness, after all it is just a little corner of one of our 149 national forests ---- he has a total summer force of 52 men. That is an average of one man to each 5000-odd acres.

Those fifty-two are Bill's first line of defense against forest fires. Bill is the fire chief. I'm not going to tell you any tales of heroism, of thrilling rescues, and daring struggles of men trapped in the flames and smoke. The records of the United States Forest Service are full of them. They have been told in song and story. Most any old forester can set your spine tingling with some which have never seen print. Some of Bill's men tell me that Bill has some first hand knowledge of fights with the fire demon which have left their scars. But Bill doesn't talk much about such things. With him, it is an everyday job, to prevent fire if possible, to put it out promptly, if started.

Roads must be kept ready for any emergency. Trail, telephone, and road crews must understand where they are to go, and what they are to do, and how to do it. Not only how to do their regular job, but what to do in case of fire, when everything is stopped and all hands fight fire, not as a wild panicky village community sometimes fights fire, but in an organized, systematic way. Bill makes arrangements with agencies and individuals in towns and on ranches near the forest borders to hire extra fire fighters when needed, assembles fire tools at strategic points. His job is to see that his protection force functions promptly and efficiently at all times. That takes training, and leadership, and inspection on his part.

And fire fighting is only the chief of his many duties. There are sales of timber from the national forest to look after and check on. In fact, Bill and his brothers have a thousand and one jobs, but I'll have to put off telling about the others until some other time.

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ANNOUNCEMENT: You have just heard a brief outline of some of the many varied duties of the forest rangers in the United States Forest Service. This outline is one of a series called "With Uncle Sam's Naturalists" which this Station -------- presents in cooperation with the United States Department of Agriculture.

UNITED STATES DEPARTMENT OF AGRICULTURE

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U. S. Department of Agriculture

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CHATS WITH THE WEATHER MAN

Friday, December 12, 1930

ANNOUNCEMENT: Our old Ob. Server has again been chatting with the weather man at the United States Weather Bureau. It seems they had some discussion about some of the instruments for measuring the weather ----- the barometer, wasn't it, Mr. Ob. Server? ***

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We were talking about the aneroid barometer.

Ane-roid is not a girl's name. Aneroid comes from two Greek words. It means "not wet."

You know, it is one of those little round, flat tin-box affairs, with a lot of figures around a dial. I have one hanging up in my house. Maybe, you have, too. Some people who try to figure out the figures on some aneroid barometers, seem to think that the aneroid barometer is all wet, as the saying goes.

There is no liquid of any kind in it. There is no mercury in it. There is no alcohol in it. Whatever confusion there is about it, is chiefly in the minds of some people who try to read it.

Mr. B. C. Kadel, chief of the Instrument Division of the United States Weather Bureau, says the trouble is that many of those who own aneroid barometers just don't understand them. He admits, that those figures found on the dial without apparent beginning or end, may be what throws them off.

To understand those figures, let's forget Annie for a time, and think about the mercury barometer.

Take a little glass tube, a little more than thirty inches long, and sealed at one end and open at the other, and fill it with mercury. Then stick it open end down into a cup full of mercury. What happens?

Why, only part of the mercury runs out of the tube into the cup. Mercury weighing enough to just balance the pressure of the atmosphere stays in the tube. When you set up a yardstick alongside the tube, you find that the upper end of the mercury in the tube is about 30 inches above the surface of the mercury in the cup.

That is, you do if you live in a low place like Washington, D. C.--- I mean one that is near sea-level. If you tried that same experiment, at the top of a skyscraper, 500 feet high or on top of the Washington Monument, you'd probably find that the column of mercury in your glass tube was only 29½ inches. That would be because you would be above some of the atmosphere.

If you were on top of the Allegheny Mountains, you might try the same experiment, and your column of mercury would stand only about 27 inches high. And so on. The higher up you go, the less air there is to press down on the mercury in the cup and so the shorter the column of mercury the air will hold up.

But no matter where you are, high-up or low-down, if you keep your barometer in one place continuously and read it often, you find that the column of mercury varies a little in height. You'll find it varies from day to day, and even from morning to afternoon. But the biggest variation you get is usually less than an inch above or below the average.

That being the case, you will have use for only a few of the figures on your yardstick. Barometer manufacturers, Mr. Kadel explains, not only leave off the useless figures, but the unneeded part of the yardstick as well.

Now then, let's take another squint at our old friend, Annie -- Aneroid Barometer.

It is a simple little instrument. Just a little flat round metal box sealed air tight with solder and exhausted of air. One flat end of the box is secured rigidly to the frame of the instrument. With no air inside, and the air pressing on it outside, the two flat ends of that tin box would be crushed together. That just wouldn't do.

To prevent that, Mr. Kadel explains, the manufacturer attaches a spring to the other flat end of the box, to hold the two ends apart. That has to be a good, strong spring, too. It has to hold back against a pull of 50 pounds or more, depending on the diameter of the little box.

So far, that's simple enough. Well, that is almost all there is to it. When the pressure changes, the free end of the box moves a tiny bit inward or outward as the case may be. That's the way Annie measures the changes in the pressure of the atmosphere. That movement of the free end of the box is magnified by a train of levers which communicate the motion to the hand or pointer you see on the dial.

The numbers that run around the dial, the chief of the instrument division says, are taken from our same old yardstick. They have been chosen by the manufacturer of the aneroid barometer in the same way as those on the mercury barometer. In fact, a measured mercury column is used by the manufacturer to find out where to put the markings.

This simple explanation helped me to understand how barometers work. Of course, when it comes to actually building an aneroid barometer -- well that's something that takes unusual skill and special equipment, Mr. Kadel assures me. -------Now, I know you are thinking about the same thing I was when he told me all this.

Some of us literally live on a lower plane than others. If the reading of the barometer varies, as it does, with elevation, how can we compare results, say on the mountain top with those on the sea-shore? How can barometers at different elevations speak the same language, as it were?

Of course, that's just a simple problem in addition. The quaint old weather custom, is to add to the reading made at a high location a quantity that represents the weight of a column of air extending downward to sea level would have.

But right there, the Instrument Chief tells me, is where some of us sometimes get befuddled with our barometers. Some manufacturers attach special devices to the dials to do the adding for us. And some of us just set the reading far enough ahead to include the amount we would have to add.

Mr. Kadel insists that since the amount to be added is more at one time than another, both those systems are unsound. It is plainly impractical to try to dodge the job of doing that simple problem in addition.

Now, here is the way he taught me to test my aneroid barometer to see if it is working right. You just take the barometer with you up on a hill or a high building, and watch the action of the hand on the dial.

That hand should vary about one-hundredth of an inch for each ten feet of change in level.

To find out if your barometer is correct, make a reading about 8 o'clock in the morning; if it is summer time, you add one inch for each thousand feet up. In the winter, the air is colder and weighs more, so you add about an inch and a tenth for each 1000 feet up. In the fall and spring, you split the difference, and add one and five-hundredths inches.

Then you watch the newspaper for the published value for your nearest Weather Bureau Station. If you barometer agrees within 5 ot 6 hundredths of an inch with the Weather Bureau barometer, it is about as good as you can ordinarily expect.

And, by the way, Mr. Kadel says, hang your barometer in the house. The pressure is the same in the ordinary room as it is outdoors. And don't be confused by an extra hand that is sometimes fastened to the glass cover over the face of the instrument. It is only a marker to save you the trouble of remembering the reading the last time you looked at Annie.

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ANNOUNCEMENT: You have just listened to a description of that much misunderstood instrument, the aneroid barometer. Two weeks from today, we will have another chat with some of the specialists of the United States Weather Bureau. Station presents these talks in cooperation with the United States Department of Agriculture.

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CHATS WITH THE WEATHER MAN

Friday, December 26, 1930.

ANNOUNCEMENT: No matter what the day, nor where the place, the weather is important. Our old friend, Ob Server, has been talking with scientists of the United States Weather Bureau again. This time it is about another of the many services of the Bureau ----- But I'm going to let him tell you about that ------ Well, Mr. Ob. Server.

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As Mr. W. W. Reed, of the climatological division of the United States Weather Bureau, reminds me, our Weather Bureau didn't spring into being over night.

Its far-flung net-work of stations, tied together by wire and radio, and systematicly reporting to central headquarters, is a gradual development.

In its present form, it is just about forty years old. Before that it was part of the U. S. Army. It came into being as a branch of the Signal Corps. Our first regular weather stations were at military posts about sixty years ago. Before that Scientists of the Smithsonian Institution were doing some investigating of the weather. And before any government or semi-governmental organization took hold, individuals were watching and recording weather conditions. Ben Franklin and Tom Jefferson were among our early independent weather observers.

And, Mr. Reed says, that is the way it has been in other countries. First interested individuals, scattered here, there and yonder, begin keeping weather records. Then comes closer organization, and finally systematized observation under the direction of a central office and a network of stations.

Mr. Reed has recently completed a compilation of climatic records for South America. And from what he tells me, it seems that in that vast continent to the South of us are to be found weather services in nearly all stages of development.

In southern South America, Argentina, Chili, and Uruguay each have had central institutions with a network of stations collecting weather reports for many years. There are not many big regions which do not have weather stations.

In northern South America, in Dutch and British Guiana, Venezuela and Brazil, there are also networks of stations under central offices, which have been developed to such an extent they can give a fairly comprehensive view of the prevailing weather conditions over their various parts.

In other countries, Mr. Reed says, there has been little or no coordination of efforts to determine climatic conditions. Vast areas are still almost entirely unexplored. However, there are many stations in and west of the Andes Mountains at which weather records have been kept for rather long series of years. Those stations are irregularly distributed over the territory. They are located at various places from sea level to 15,000 feet above sea level. From the records of those stations it is possible to make a fairly accurate estimate of the temperature for any place in that territory, when you know its elevation.

But suppose one of our "good-will" aviators wants to get the needed weather information for a flight through South America. How is he going to know what kind of weather he is likely to find in the different countries along his route? Of course, you say, he can apply to the weather services of these countries. Yes, but you must remember that there are a number of different countries involved. And you must also remember that some of them have not yet developed as complete services as others. Some of the information might have to come from independent, scattered station records published here, there, and everywhere. Obviously, the air pilot would be able to gain only a patchwork of information; even if he had the months, or even years, of time he would need to hunt down the scattered records.

That is not an altogether fanciful case, either. Mr. Reed mentioned that the U. S. Weather Bureau has been actually called upon for weather records for use on just such a flight.

Then there are those pioneer souls who see the opportunities of a new country beckoning to them from certain parts of South America. They often want to know whether the climate where they propose to settle will fit in with their plans. They call upon the Weather Bureau for the answer.

More often, however, it is the practical business man and shipper in this country who needs to know about the climate. The rainfall at certain times of the year may determine how he will pack his goods, or when he will ship, or whether it will pay him to ship at all. Where is the answer?

Well, that is one of the things Mr. Reed is working on. He is gathering together the temperature and rainfall records from all parts of South America. He is working out the averages for each month of the year.

That's evidently quite a job. Sometimes just one little line of figures giving the mean monthly and annual temperature for one station, means adding up the records of twenty years and hours of calculation.

Fortunately, he doesn't have to include Brazil in his compilation, because there are already comprehensive records of the climate of that country written in Portuguese. As it is mostly a matter of figures, our weather men don't even have to know how to read Portuguese to get the accurate picture of the climate from those records.

On first thought, you might think it would be easy to just figure South American climate from what we know of North American climate. You would naturally expect that the weather in December at a place a certain distance below the equator would be about the same it is in June at a place an equal distance above the equator.

But then there is the question of elevation. Weather comes in three dimensions, you might say. For instance, on the northern border of Argentina, due to ths influence of the Andes mountains, there is a change in the average year-round temperature from east to west of 22 degrees in the short distance of 100 miles.

In the interior of temperate South America you might expect to find much the same climate we have in the interior of our country, until you realize that the southern part of South America slopes more to a point. It is narrower, and there is not the room to develop the continental type of climate we have in the middle of our country.

On the northern coast of Chili, with winds from the ocean, moisture in the air, and clouds overhead, you would naturally look for rain. Yet that is one of the most outstanding regions for lack of rainfall on the face of the earth. That, Mr. Reed explains, is largely traceable to effect of cool ocean currents which wash those shores, and to the fact that winds from the other side of the continent drop their rain in trying to climb the steeps of the Andes mountains.

You see this matter of climate is complicated. To really know your weather for any place it takes regular records taken near the spot. And to have those records on hand for our business and other interests to use means collecting the figures from many sources and days and months of work arranging them in convenient tables, so "he who runs may read." That is what the U. S. Weather Bureau is doing with the records from governments, and institutions, and independent observers throughout all South America.

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ANNOUNCEMENT: Just another of these services of the United States Weather Bureau. This time the work was outlined to your old friend, Ob. Server by Mr. W. W. Reed, of the Bureau's climatological division. We will have another chat with the weather man two weeks from today.